2012

CTFA Project Report

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Controlled Traffic Farming Alberta

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Introduction

"Controlled traffic farming (CTF) is a crop production system in which the crop zone and traffic lanes are distinctly and permanently separated. In practice it means that all implements have a particular span or multiple of it and all wheel tracks are confined to specific traffic lanes".[1]

Controlled Traffic Farming Alberta (CTFA) is a farmer led initiative to evaluate and assess controlled traffic farming in Alberta and help farmers reduce the risk of adoption. CTFA is funded by the Agriculture & Food Council, Agriculture and Agri-Food Canada and the CAAP program. Additional funding and help comes from our partners: the Alberta Crop Industry Development Fund, Alberta Canola Producers Commission, Alberta Barley Commission, Alberta Pulse Growers, Alberta Winter Wheat Producers Commission, Farmers Edge, Beyond Agronomy, Point Forward Solutions and Agricultural Research and Extension Council of Alberta.

More information is available on the CTFA website at www.controlledtrafficfarming.org.

Figure 1. CTFA partners

[1] No Tillage seeding in Conservation Agriculture. 2nd Edition. Eds C.J. Baker and K.E. Saxton. FAO and CAB International, 2007.

Project Description

The CTF project is using field-scale applied research to evaluate the agronomic and economic benefit of CTF in Alberta. Five co-operators are involved in the project and use field-scale equipment on plots ranging from 140 acres to 480 acres. The check plot is the farmer's normal random traffic system, and CTF is the comparison. The three year project started in 2011 and will be completed in 2013.

Site Locations

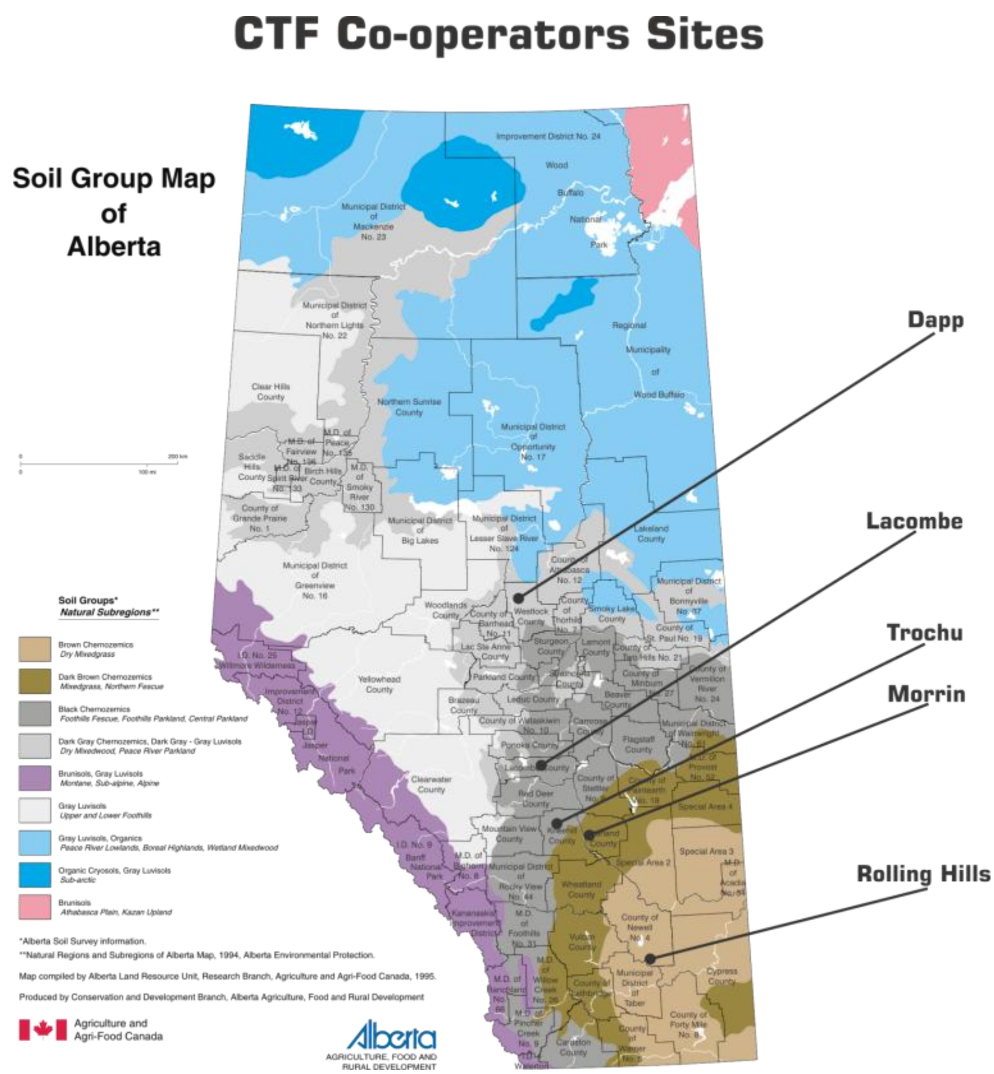


Figure 2. Location and soil groups for the five farm co-operators

Site Descriptions

Table 1. Climate data for the five CTF co-operator locations. Averages are calculated from the 1971-2000 Alberta Agriculture data.

Site #	Location	Frost Free Days	Days Above 5^0C	Corn Heat Units	Growing Season Precipation (mm)	Total Precipation (mm)
1	Dapp	105-115	165-170	1800-2000	300-325	450-500
2	Lacombe	105-115	180-185	1800-2000	300-325	450-500
3	Trochu	105-115	180-185	2000-2200	225-250	400-450
4	Morrin	115-125	180-185	2200-2400	225-250	350-400
5	Rolling Hills	>125	>185	>2400	<200	<350

Soils Information[2]

Dapp - The sandy loam to sandy clay loam soils at the Dapp site are Dark Gray Luvisols on fine textured (C, SiC) water-laid sediments. The series is 60% Heldar; 20% Westerose and 20% miscellaneous Gleysol. The polygon includes poorly drained soils and soils that are coarser textured than the dominant or co-dominant soils. The land is an undulating, low relief landform with a limiting slope of 2%.

Lacombe - The sandy loam soils at the Lacombe site are Eluviated Black Chernozems (Mollisols in the USA soil classification systems) on medium textured (L, CL) till (Cygnet) as well as Orthic Black Chernozems on medium textured (L, SiCL, CL) materials over medium (L, CL) or fine (C) textured till (Lonepine). The series is 50% Cygnet and 50% Lonepine. The polygon may include soils that are not strongly contrasting from the dominant or codominant soils. The land is an undulating, high relief landform with a limiting slope of 4%.

Trochu - The clay soils at the Trochu site are Orthic Black Chernozems on very fine textured (HC) water-laid sediments (Three Hills). The polygon includes poorly drained and Solonetzic soils. The series is Three Hills 60%; Misc Solonetz 20%; miscellaneous Gleysol 20%. The land is an undulating, high relief landform with a limiting slope of 4%.

Morrin - The clay to heavy clay soils at the Morrin site are Orthic Humic Vertisols on very fine textured (HC) water-laid sediments (DMH). The series is Heldar 60%; Westerose 20%; and miscellaneous Gleysol 20%. The polygon may include soils that are not strongly contrasting from the dominant or codominant soils. The land is an undulating, high relief landform with a limiting slope of 4%.

Rolling Hills - The irrigated soils at Rolling Hills are Orthic Brown Chernozems on medium textured (L, SiL) sediments deposited by wind and water. The series is Chin 60%, Tilley 20%, Wardlow 10% and Karlsbad 10%. For irrigation it is classified as Class 2, well drained and low in salts, with some Class 5 traits, characterized by imperfectly to poorly drained soils with some strongly saline and sodic profiles. The corners of the center pivot irrigation are dryland.

[2] http://www4.agric.gov.ab.ca/agrasidviewer/

Bulk Density and Pore Space

Alberta Agriculture and Rural Development took core samples of the sites in the fall of 2011.

Figure 3. AARD staff taking core samples from a co-operators site

Soil sample cores were taken to 90 cm from the check and CTF plots. The soil samples were used to determine bulk density, porosity, particle size, texture, pore space and water holding capacity. The average pore space and bulk densities for the sites are shown in Table 2.

Table 2. Average bulk densities and pore space from four co-operator sites in 2011

Average Bulk Densities & Pore Space – Fall 2011					
		Check		CTF	
	Depth (inches)	Db	Pore %	Db	Pore %
Site 1	0-6	1.36	48.51	1.27	52.07
	6-12	1.53	42.14	1.45	45.39
	12-24	1.50	43.35	1.48	44.16
	24-36	1.51	42.83	1.55	41.55
Site 2	0-6	1.33	49.80	1.12	57.89
	6-12	1.39	47.48	1.11	58.05
	12-24	1.38	47.80	1.20	54.71
	24-36	1.75	33.88	1.48	44.30
Site 3	0-6	1.12	57.66	1.08	59.24
	6-12	1.30	50.80	1.34	49.27
	12-24	1.28	51.78	1.34	49.42
	24-36	1.29	51.22	1.56	41.16
Site 4	0-6			0.84	68.20
	6-12			0.95	64.21
	12-24			1.05	60.43
	24-36			1.20	54.63

Figure 4 shows the bulk density (Db) at different locations in relation to wheel traffic on the sites.

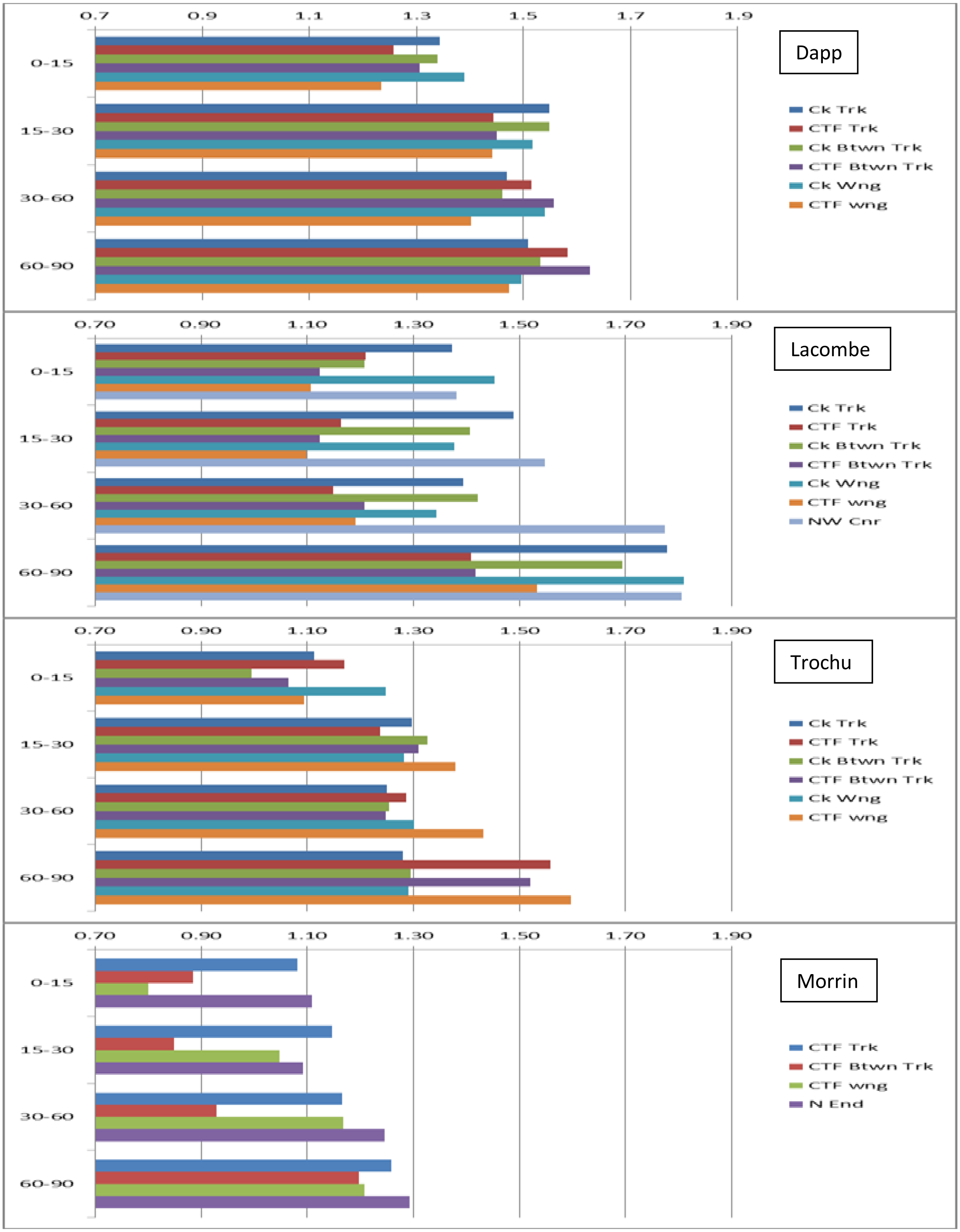


Figure 4. Bulk densities taken from CTF and check sites at four co-operator sites in 2011

Available Water Capacity

Figures 5-8 below depict the amount of pore space and maximum available water capacity of the soil samples. Since samples were only taken near the intersection of the check and CTF plots they do not represent all soil variability within the fields. Available water capacity is derived from texture and pore space is derived from Db.

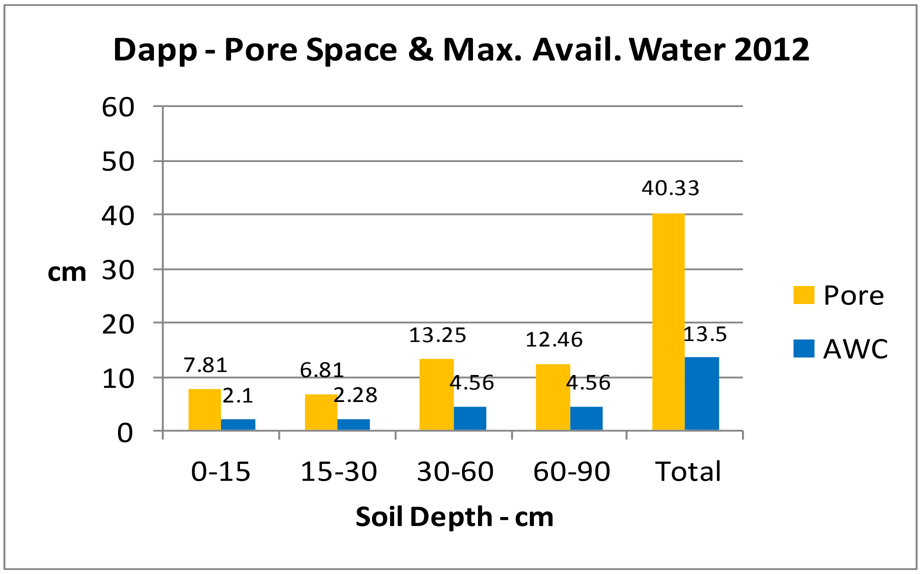


Figure 5. Pore space and maximum water availability at the Dapp site

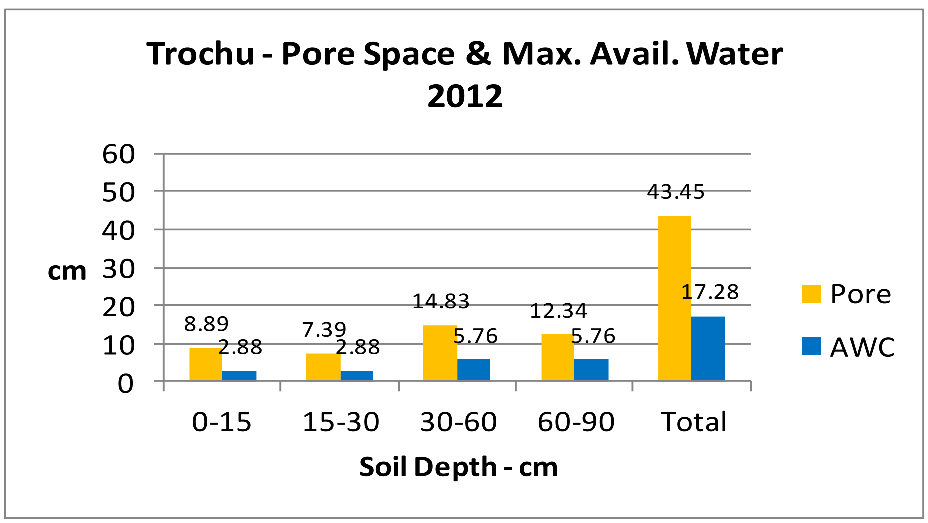


Figure 6. Pore space and maximum water availability at the Trochu site

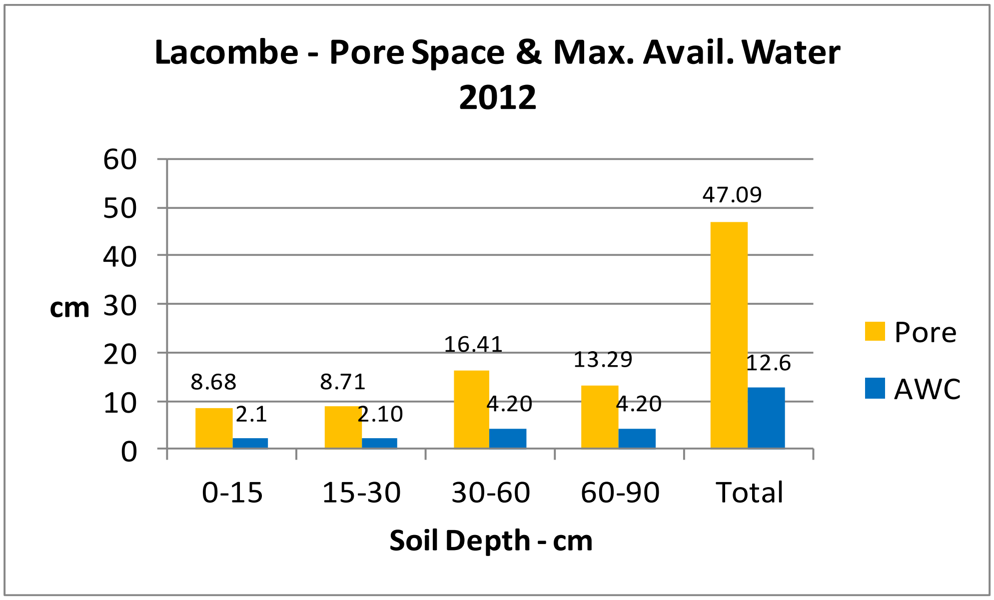


Figure 7. Pore space and maximum water availability at the Lacombe site

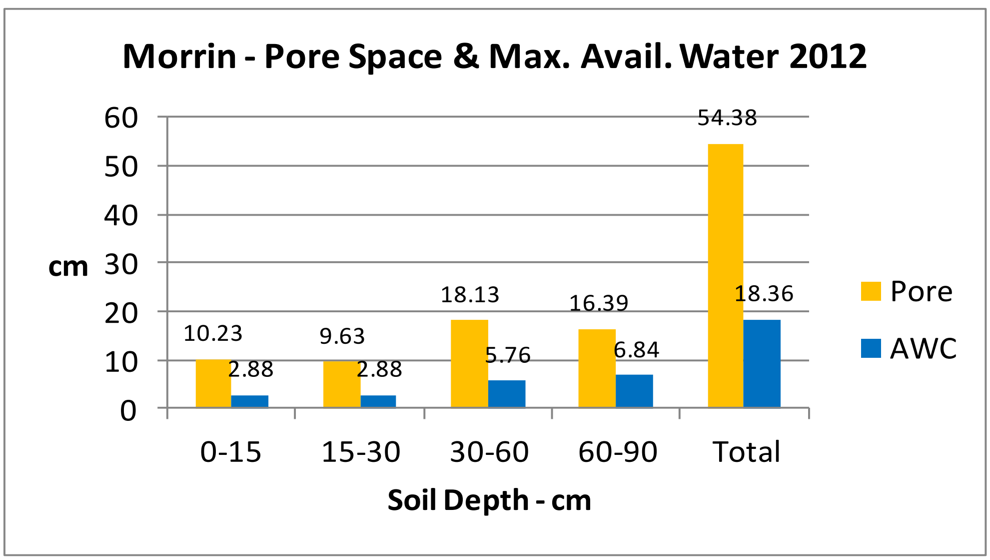


Figure 8. Pore space and maximum water availability at the Morrin site

Table 3. Available water in the profile (inches) at the four co-operator sites.

Available Water		
	Inches in 90 cm	Inches/ft
Dapp	5.3	1.8
Trochu	6.8	2.31
Lacombe	4.96	1.68
Morrin	7.23	2.45

Ground Pressure

Figure 9: Ground Pressure Rig

Point Forward Solutions, a partner, took penetrometer readings to 18 inches of depth in the fall of 2011 and spring and fall of 2012. The readings are geo-referenced in one acre blocks. Table 4 depicts the range of ground pressures for the fall of 2012. Maps of each site are in Appendix One.

Table 4. Ground pressure taken in fall of 2012.

Ground Resistance - Fall 2012 Range in psi					
Inches	**Site 1**	**Site 2**	**Site 3**	**Site 4**	**Site 5**
0-6	57-230	68-282	86-325	91-221	114-429
6-12	85-323	74-408	117-354	97-258	0-413
12-18	80-354	0-394	85-869	91-267	0-422

Imagery

The sites were flown in late June and early July to take Normalized Difference Vegetation Index (NDVI) images at one meter resolution. The images are shown in Appendix 2. Satellite imagery was also provided by Farmers Edge, one of our partners.

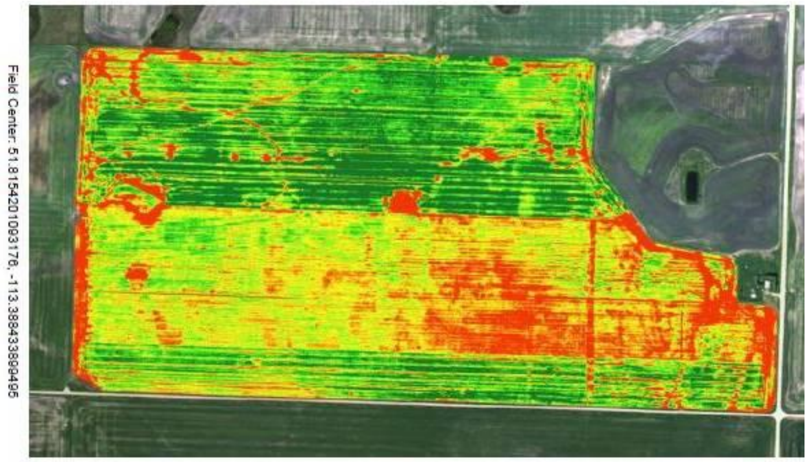


Figure 10. Normailized difference vegetation index image

Weed Communities

Agriculture and Agri-Food Canada is monitoring weed populations in the CTF and check plots at four sites. Weeds populations are counted each spring, prior to incrop spraying, with a view to determining if there are any shifts in populations between the CTF and check. Counts in 2012 do not reveal any population shifts. The tables are shown in Appendix 3.

Weather

The weather was variable at all of the sites, although rainfall was similar. Saturated conditions in early spring impacted the Lacombe site. There was heavy damage from hail on the Morrin site. Standing stubble from last year's barley kept the peas standing enough to enable harvest. Table 5 shows rainfall for 2012. Climate information is shown in Appendix Four.

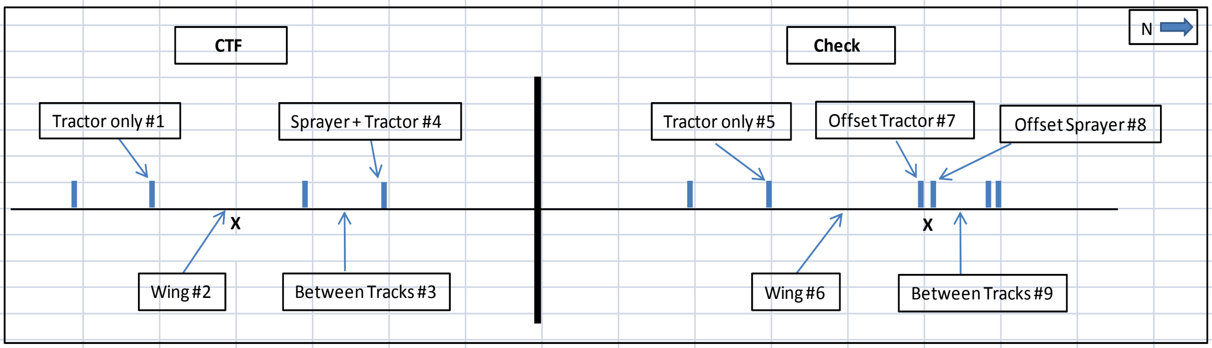
Table 5. Growing Season Rainfall 2012

Growing Season Rainfall 2012		
Location	mm	inches
Dapp	240	9.45
Lacombe	250	9.84
Trochu	260	10.24
Morrin	260	10.24
Rolling Hills*	208	8.19
* additional irrigation	90	3.54

Water Infiltration

Water infiltration is a measure of the time it takes to infiltrate one inch of water into the soil. A seven inch ring was used to collect this data. Figure 11 depicts how the testing was done, and Figure 12 shows the results of the tests.

CTF Infiltration - James Jackson - June 25, 2012. CPS wheat at 5 - 6 leaf with 1 -2 tillers.



Time to infiltrate 1 inch of water

CTF	Test #	Time - Seconds		**Check**	Test #	Time - Seconds	
Wing #2	1	21		Wing #6	1	158	
	2	47			2	299	
	3	85	600+ applied 2'nd inch		3	101	
	4	120	266 applied 2'nd inch		4	94	214 applied 2'nd inch
Tractor only #1	1	300		Tractor only #5	1	2460	
	2	880					
Between Tracks #3	1	47		Between Tracks #9	1	140	
	2	25			2	267	
	3	43			3	72	
Sprayer + Tractor #4	1	2400+		Offset Tractor #7	1	2400+	
	2	2400+					
				Offset Sprayer #8	1	2400+	

Notes
CTF location (X) N 54' 24.366"; W 114' 02.087".
Check location (X) N 54' 24.389" W 114' 02.084".
Moisture - probe easy to 8-10 inches, hard to 2 feet and then very easy; estimate 60-70% available moisture in top 10 " and 75% to 24", and more than field capacity below 24".
Sprayer trams still had water after 2400 seconds (40 minutes) as did check Offset Tractor #7.
Locations 1, 2, 3, etc are separate spots except where noted that a second application of water was made

Figure 11. Detailed drawing of water infiltration collection set-up and tests

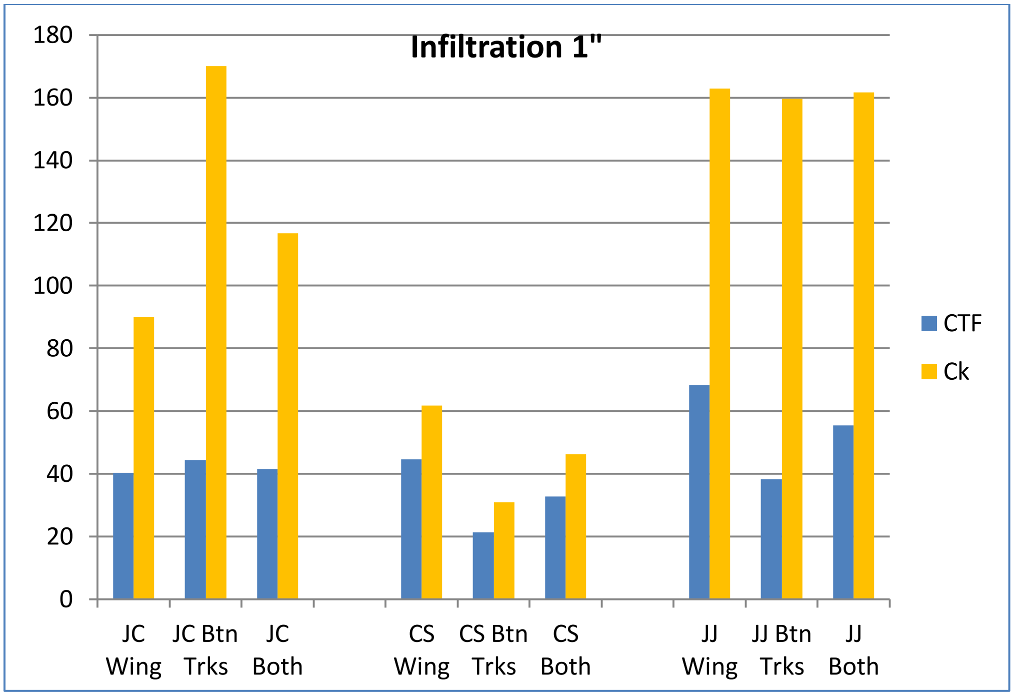


Figure 13. Water infiltration test with a 7" ring.

JC = Trochu; CS = Lacombe and JJ = Dapp

Figure 12. Seconds to infiltrate 1 inch of water into the soil at three co-operator sites

Yield

The plot yield data for 2012 was analyzed in two ways. Figure 14 shows data taken by combine yield monitors, from plots selected from within the CTF and check plots. The plot yields are matched for variable rate fertilizer, elevation and soil zone. Statistical analysis was applied to this data and three of the four plots had significant yield differences. Sites One and Five have checks that appear to be in higher yielding areas based on prior yield data. Figure 15 depicts how the statistical data was derived.

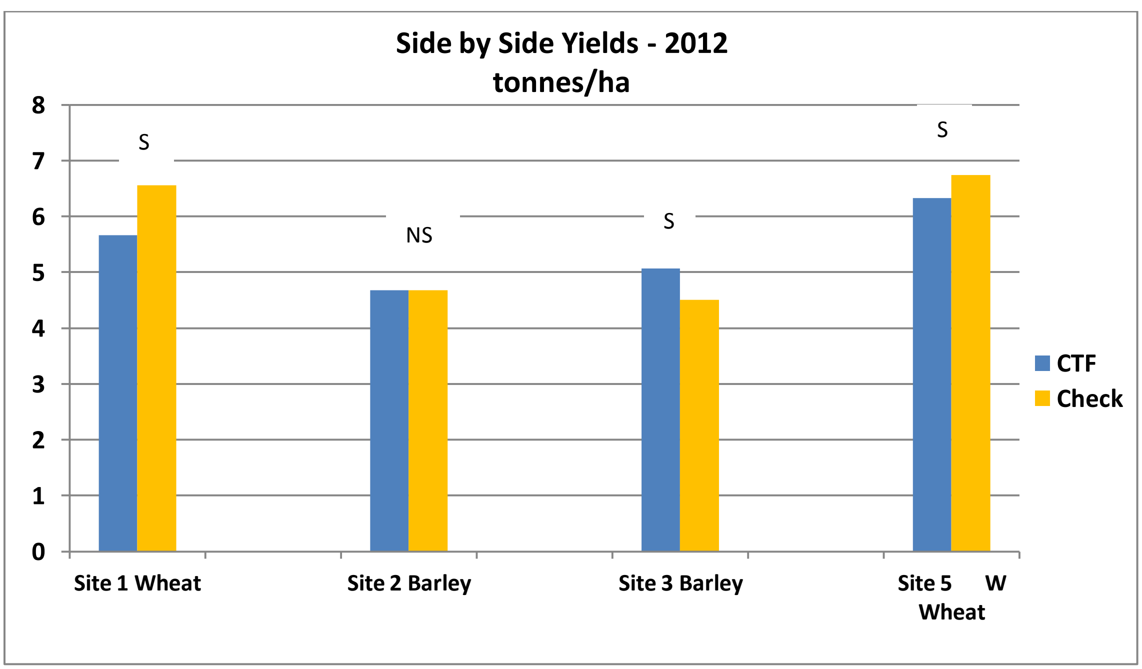


Figure 14. Yields collected from combine yield monitors of the CTF and check plots

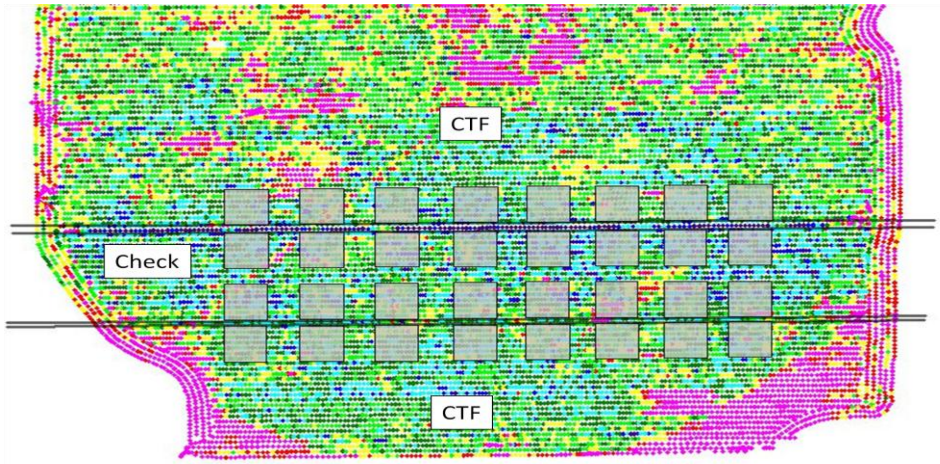


Figure 15. Diagram showing how yield data was collected for CTF and check plots

Figure 16 is a comparison of the total yields for the CTF plots and the check plots. Statistical analysis cannot be applied to this data.

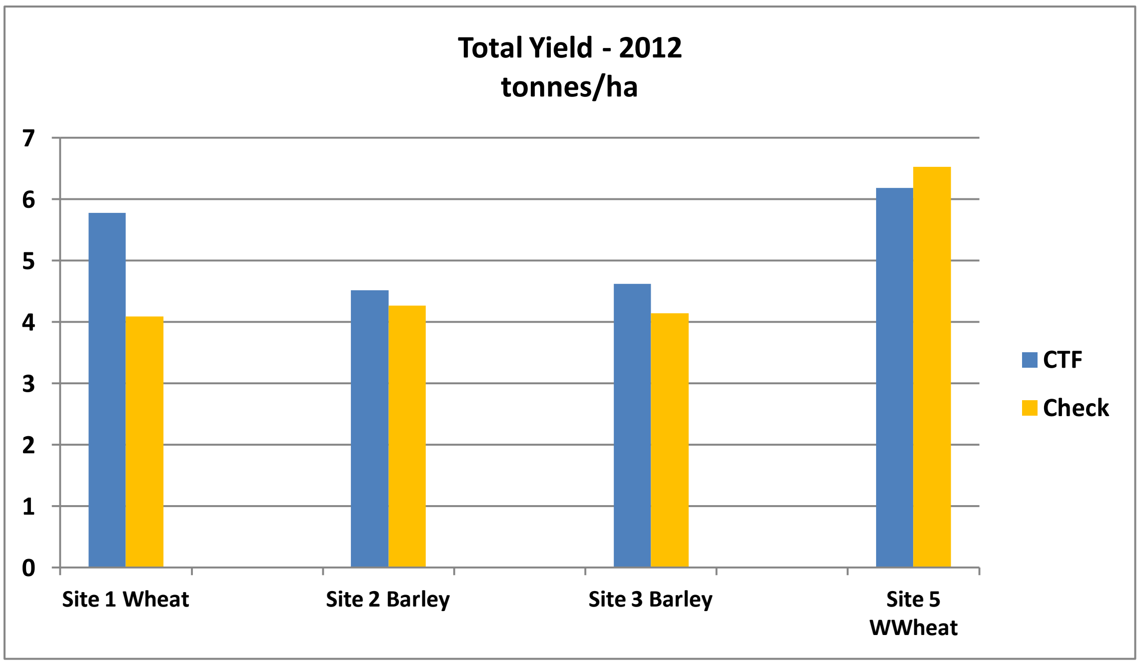


Figure 16. Total yields of CTF and check plots

The data presented should be viewed with caution as it is only data from one growing season. The data for the Morrin site is not reported due to heavy hail damage. Yield images are shown in Appendix Five.

Water Use Efficiency

Water use efficiency was calculated using the formula: Spring Soil Moisture + Growing Season Rainfall – Fall Soil Moisture – 90 mm Evaporation Loss. The data is from the side by side yields. Figure 17 shows the results from the spring of 2012.

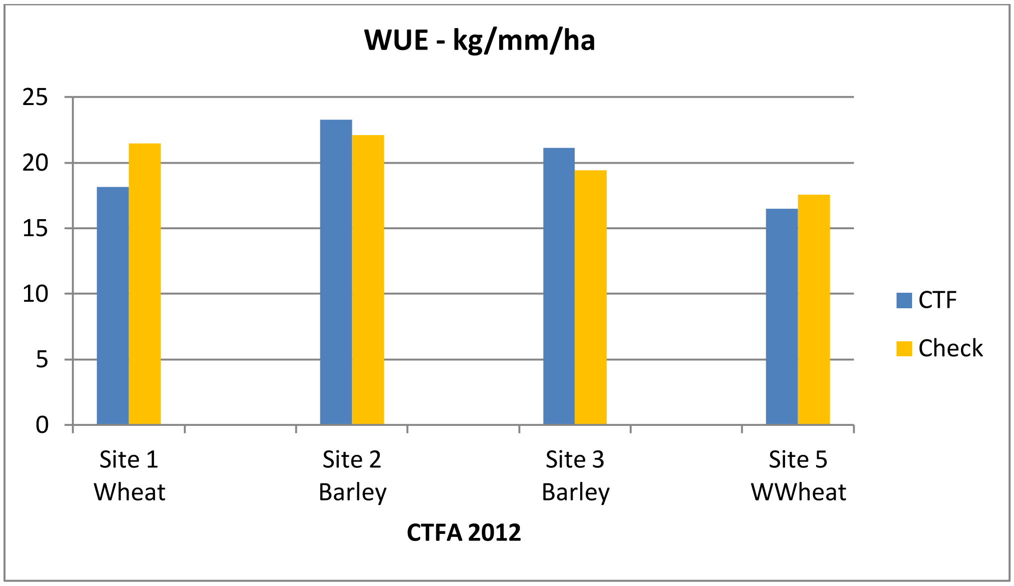


Figure 17. Water use efficiency from spring 2012

Economic Analysis

As described in the 2011 Economic Analysis and Report[3] the economic assessment of Controlled Traffic Farming (CTF) systems was undertaken using the following approaches:

1. Comparative Budgets to compare revenues, input costs and gross margins of acres operated under a CTF system with CHECK acres reflecting the existing system that has an element of random traffic. These budgets frameworks illustrate the changes in yields, revenues, input quantities and input costs achieved by the CTF system for each cooperating producer.

2. Net Present Value (NPV) Analysis takes the perspective that an investment in CTF is made in today's dollars in return for a future stream of net cash revenues. These dollars, to be received in the future, are discounted to a present value since a dollar earned in the future is worth less than a dollar today. The present value of the future benefits provides a measure of the economic returns gained by investing in CTF.

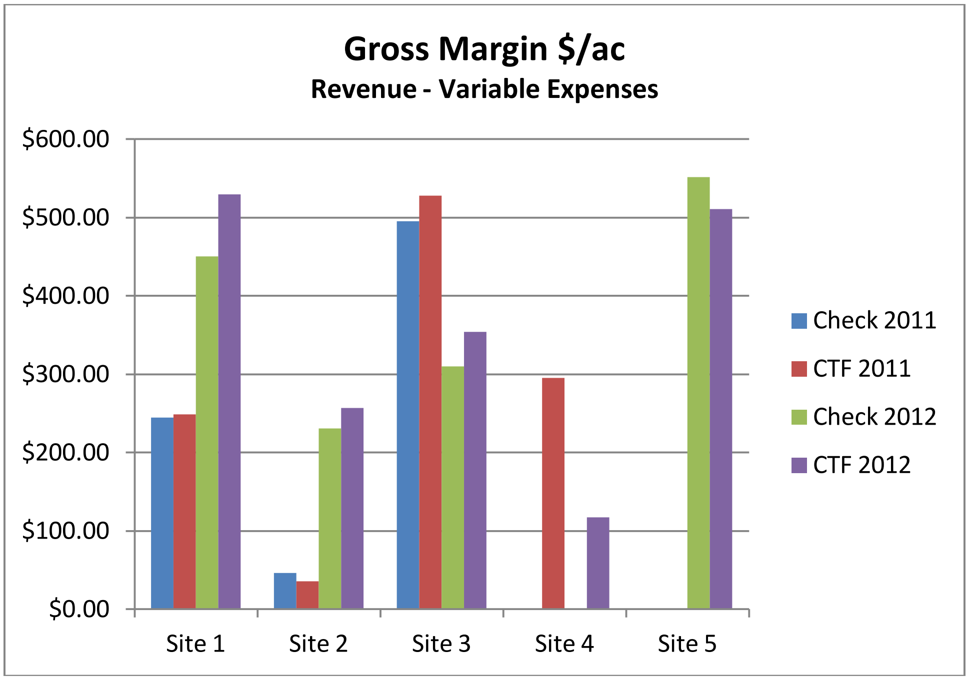
The 2012 data on yields, revenues, key input costs and gross margins for each participating farm are presented in Table 5 and Figures 19 and 20. A detailed report is available in the 2012 Economic Analysis and Report[4]. Four of the participating farms were able to compare their CTF performance with their check acres that reflected random traffic. These comparisons made it possible to measure the net benefit that might be attributed to the CTF system for each individual farm.

[3] Dey, Dennis. 2011 Economic Analysis and Report. http://canola.ab.ca/ctf_plot_reports.aspx
[4] Dey, Dennis. 2012 Economic Analysis and Report. http://canola.ab.ca/ctf_plot_reports.aspx

Table 5. Revenues, inputs and net benefits of CTF performance at each co-operator's site.

	#1		#2		#3		#4		#5	
Crop	**CPS Wheat**		**Barley**		**Barley**		**Yellow Peas**		**Winter Wheat**	
	CHECK	CTF	CHECK	CTF	CHECK	CTF	CHECK	CTF	CHECK	CTF
Acres	171	275	76	80.8	44.5	75.5		160	21.44	108.56
Yield (Bu./Acre)	76.00	86.00	79.38	84.03	76.99	86.00		40.00	97.15	92.00
Price ($/Bushel)	$8.00	$8.00	$5.50	$5.50	$6.25	$6.25		$7.50	$7.87	$7.87
Revenue per Acre ($/Acre)	**$608.00**	**$688.00**	**$436.59**	**$462.17**	**$481.18**	**$537.50**		**$300.00**	**$764.57**	**$724.04**
Key Input Costs ($/Acre)										
Seed	$27.00	$27.00	$29.70	$29.70	$18.75	$18.75		$44.80	$28.44	$28.44
Fertilizer	$93.51	$93.51	$65.42	$65.42	$68.75	$68.75		$0.00	$135.37	$135.37
Chemical	$21.13	$21.13	$44.00	$44.00	$34.50	$34.50		$50.42	$30.98	$30.98
Fuel	$7.02	$7.69	$26.29	$26.29	$9.51	$9.59		$27.80	$9.62	$9.62
Labour	n/a	n/a	$30.00	$30.00	$8.99	$21.19		$10.88	n/a	n/a
Custom	$9.00	$9.00	$10.00	$10.00	$31.00	$31.00		$48.41	$8.50	$8.50
Total Variable Costs	**$157.65**	**$158.32**	**$205.41**	**$205.41**	**$171.50**	**$183.78**		**$182.31**	**$212.92**	**$212.92**
Gross Margin ($/Acre)	$450.35	$529.68	$213.18	$256.76	$309.68	$353.72		$117.69	$551.66	$511.12
Net Benefit ($/acre) to CTF	**$79.33**		**$25.57**		**$44.04**		**n/a**		**-$40.53**	

Notes: The crop for Site #4 had severe hail damage affecting the yield, revenues and gross margin. Crop insurance payouts were not included in this analysis.



Notes: Site 2 hail year 1 and saturated spring condition year 2;
Site 4 has no check, hail 2nd year; Site 5 is the 1st year

Figure 19. Gross margins of CTF and check acres for 2011 and 2012

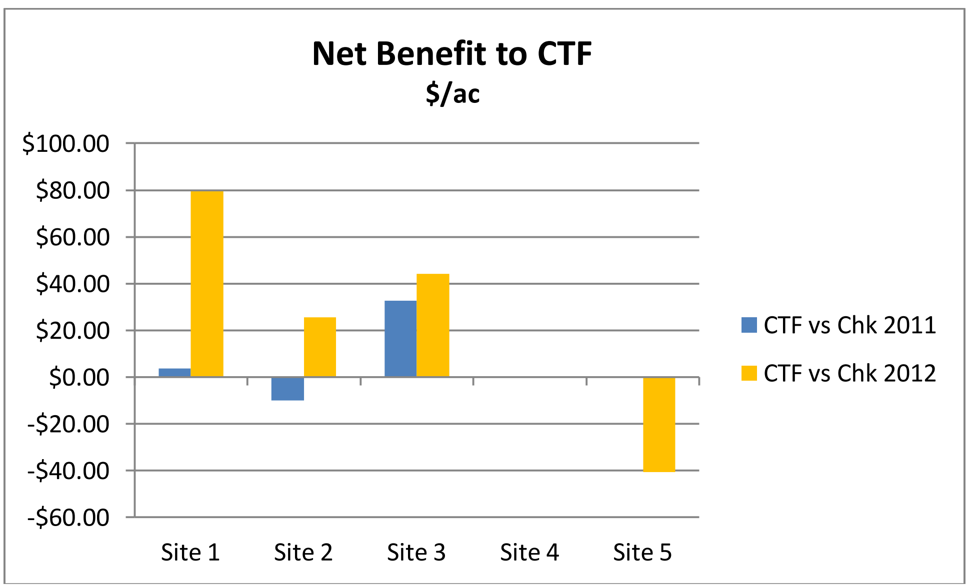


Figure 20. Net benefit of CTF versus check acres for 2011 and 2012

Co-operator Observations

James Jackson, Jackson Farms, Dapp, Alberta Our second year of CTF went somewhat better weather-wise than the previous year. We did have heavy rains this year but they were spread out more and thus avoided the pooling that occurred in 2011. The field conditions were very good for seeding, spraying and harvesting. Rutting does not seem to be a problem other than when we have the narrow tires on the JD 4940 sprayer.

We seeded with the JD 1895 disc drill again and for the most part it went well. It is hard to do inter-row with the wide gauge wheels and the drill being a mirror image left to right. You can seed between the rows but the gauge wheels do take down the stubble. All fertilizer was applied at the time of seeding. This is something we do not usually do, and we feel as though the fall application of fertilizer with a tine helps warm the soil in the spring; it also helps speed the seeding process. Most of our farm gets banded in the fall so usually we can pick the day to seed the CTF field therefore minimizing certain adverse conditions.

The 120' JD 4940 sprayer really covers the ground quickly but is very heavy. When you get the second headland done you have 2 bumps to cross at the end of each pass. It will be interesting to see if tracks help soften these ruts in the future. The 120' system works fine with CTF, tracking is set at 118' as the seeder runs on 29.5'.

Three JD S-680's were used for harvest, 30' heads with 29.5' track spacing. With singles the machines run a bit rougher in the field than the duals we are used to running but overall no big problems. We ran two grain carts and it does take extra time to keep combines going. There probably is a better pattern one could follow.

The CTF field was harrowed with 60' McFarlane harrows after combining. We had very good conditions for this operation and it did do a very good job. Going the same way as the combines travel seems to work in wheat but on some of our canola fields this operation can cause trouble on fungicide spray tracks. Not sure how we will deal with this moving forward.

There were a few problems with our cellular RTK loosing signal and moving the track unknowingly throughout the season, very frustrating at times. We do believe the problem is 95% solved now though with some address changes.

70% of our fertilizer was applied this fall using 56'Conserva Paks. Next year we will be seeding with a 60' 1890 and 30' 1895. At this point we are not sure how we will apply fertilizer next fall. The plan is to pull the 60' with an 8360 RT John Deere and 30' with the 8430. The 56' Conserva Paks were one operation that we could not get on CTF. So moving forward we will progressively get things sized up. There still will be some challenges I am sure. Harrowing and seeding with tracks combined with a wet spring can cause some real problems.

I find it amazing how quickly we get used to the CTF concept. It is fantastic to move from field to field with multiple machines and have everyone on the same guidance line immediately. All the track numbers are the same in each piece which is very useful for the carts and when splitting fields with combines etc. The Zone Management that is created is also very useful and makes on farm research very easy. The headers on the combines work very well with this system as well. The flex header canes that run on the ground and the gauge wheels for the draper headers do not come near the sprayer tracks.

Craig Shaw, Durango Farms, Lacombe, Alberta

Year two of the CTF project is now in the books for Durango Farms. A high water table and a wet spring continue to impact our crops. This was most prevalent in the barley and somewhat in the canola. These problems in all likelihood will impact the CTF portion of the field more than the non CTF portion so side by side combine yield data will be more relevant than overall averages. We have had some rutting in the tramlines on the CTF portion of the field and as of yet have not rectified the situation. We have planted winter wheat on the CTF field which gave us little opportunity to do any other work. We have done a fair bit of disking on the balance of the farm to try and clean up ruts in the wet ground.

Operations on the CTF field went without a hitch and were for the most part straight forward. We did nudge over to accommodate inter row seeding and as of yet do not have a solution for keeping air cart (integrated) wheels on the tramlines. We have moved to straight 10 inch row spacing and that has meant guess rows and offsets have been at a minimum. We applied fertilizer in the fall of 2011 and then seeded in the spring.

We are extremely pleased with the seeding job the Salford is doing although we did have some issues with the winter wheat. We had trouble cutting residue with the lead coulters and in the end had to go over the field twice basically using the seeder to cut residue the first pass and then went back and seeded on the second pass. The problem is related to the amount of down force we needed to cut the residue without sinking the seed too deep on softer ground. What we found this fall was while the combine did a good job with both chaff and straw spreading under good conditions it did not under damp conditions and tougher grain. We also had a fair amount of lodged crop and that also presented challenges. As a note with the seeder we did move our center seed assembles apart a little more than 10 inches so that we have a visual reference to the center of our seeding unit. This was helpful on other operations in the field.

The sprayer presented its usual challenges as we moved back and forth from 96 to 90 ft boom and we look forward to moving everything back to the original 90 ft boom for 2013. We will be replacing the outer booms on the sprayer as the extensions have created too much metal fatigue on the booms. We did put crop dividers on in 2012 and were pleased with the job they did. With our unseeded tramlines and the dividers we were able to avoid tramping in the crop especially with pre harvest. We still have an issue with matching auto steer on the sprayer with the tramlines. It seems to affect us most on side hills where the sprayer will move off the tramlines. It likely indicates an issue with tilt settings. For the most part manually following the tramlines is straight forward.

We upgraded our combine last fall to a larger rotary and have been extremely pleased with the new machine. One benefit has been that the unload auger seems to move the grain out a little further and that pretty well centers on the grain cart. We did some experimentation with running both the combine and grain cart on auto steer. With the ability of the Fendt to run a set speed we were able to match up the units very well for ease of unloading.

We have done a whole bunch more work trying to get the combine to work with the Slingshot RTK and we have yet to find a solution. This is another situation where you get caught because early in the summer it's not a pressing issue or you are busy doing other things and then once it gets into harvest no time to find a solution. We did have to do a lot of nudging with the WASS signal to remain on tramlines. We diligently remained on the tramlines with the grain cart on the CTF project field but on our other field we picked a center point on the field where we would turn and go back to the end on another tramline. Right now it would seem difficult logistically to drive a half mile to turn around especially if you are working with more than one combine.

I also wanted to comment on the Fendt tractor. In 2011 we were not happy using Ezee steer on the tractor and made the commitment to move to Ezee Pilot which is Trimble's electric steer solution. We were very happy with the new system but it created one big headache. Ezee Pilot required a new firmware upgrade and that moved the system to the new Can Bus. The problem was that we now could no longer run the seeding system off the FMX monitor without changing the system on the seeder to Can Bus. Lots of additional headaches, time and money were spent to rectify the issue.

We have found it frustrating running two different systems and have made a decision to further commit to CTF for 2013. We continue to struggle with trying to move forward when the only way to evaluate your decisions is through experience. We think we are on the right track so we will be moving forward. Our Case Steiger is being replaced with a John Deere 8360 RT track machine. This will give us a second tractor we can use for CTF. Our tow behind Flexicoil air seed tank has been swapped for a tow between unit which eliminates the castor wheel issue and we think will provide less issues with skew on side hills.

We have also purchased a 30 ft Salford RTS coulter machine which will be set up as a fertilizing unit. The concept here is to provide some residue management ahead of the seeder while maintaining some standing stubble. This unit will also replace the heavy harrow which we think won't work all that well on a tramline system. We got a little experience with the unit this fall and did have some problems with penetration on hard ground. We are working on some solutions.

The other planned change for 2013 is likely to move away from Cellular RTK to our own base station. While we are not totally unhappy with our current system there is a cost running 3 Modems and we have had some issues regarding service. We are also looking at the possibility of doing some tile drainage and felt we would need to move to our own base station to get good elevation readings. We will be determining what fields we bring on board for CTF in 2013 with a few fields likely too irregularly shaped to be practical.

Our current high water table has created a number of problems in many of our fields with erosion and rutting. Field performance remains poor in many areas and I'm not sure CTF will resolve those issues. This has meant that so called grid farming becomes difficult. We feel that the tile drainage could greatly improve this situation both from the ability of staying on tramlines and from an aspect of getting into the field in a more timely fashion.

We are still struggling with how we accommodate manure application in CTF or how we address crop destroyed by hail. We are finding that we are still struggling with some aspects of precision farming both in terms of support and compatibility. I am fortunate to have the right personnel on the farm to work through these issues.

Garry MacLagan, Grantully Farms, Rolling Hills, Alberta
We are new to the CTFA project this year, but have been implementing CTF over the past 3 years. We farm in the light brown soil zone, 100 km west of Medicine Hat. All our land is irrigated, except for the corners that the centre pivot irrigation systems do not reach. We try to incorporate these corners into the main field wherever possible by reducing seeding rates and other inputs, as this cuts down on the turning traffic, and makes all field operations, especially spraying, more efficient. We are perhaps a little different to the other co-operators in the project in that 1) we do have irrigation and 2) we grow some row-crops.

Our goal in implementing CTF was to reduce compaction within the field and to increase efficiency of operation. The latter is improved partly because you always know exactly where your next pass will be and there is no overlapping. It also makes setting up replicated variety or fertility trials very easy. Our goal in joining the CTFA project was to see if we would actually reduce compaction, improve yields, and reduce costs.

We did not expect to observe large differences between the CTF area of the field and the check area, but it was still a little disappointing that we did not. Some of the reasons for the former, is that

1) we have been no-tilling on irrigated land for about 18 years, always using a disc drill
2) we have irrigation which can help correct some agronomic mistakes

3) We have been variable rate fertilizing for 5 years which has started to show some promise in evening up the crop across the fields in the last 2 years.

We have noticed that in some areas of the field when driving on the tram-lines there can be more wheel-slip because the tire lugs are not fully engaging the soil on the hard-packed tracks. This is noted by comparing the tractor speed, measured by driven axle rotation, to that of the aircart speed, measured also by axle rotation, but non-driven. Conversely, when driving in the non-CTF area, both the engine rpm and tractor speed drops, and it seems that this is because the 240 bu. air-cart is sinking into the soil and providing significantly more rolling resistance than when being pulled on the hard-packed tramlines. There is more forward speed loss from pulling the cart through softer soil, than there is from wheel slip, but I have noted this so that it can be investigated more thoroughly next year. It also seemed that this difference was more amplified in wetter soils, than drier soils.

We did not measure any difference in combine fuel use, possibly because all the fields were so dry at harvest-time, that floatation under load was good under both circumstances.

Another advantage we observed was being able to get into the field to spray after a heavy rain way sooner than we had in the past. In the wet years prior to 2012 we could spray while running on the tram lines soon after a rain, but if you slipped off, you were stuck. This year, however, the tram-lines are a little deeper than in previous years, so we never slipped off them, even at the headlands.

Because one of the most compacting pieces of equipment on the farm is a grain-cart, we were fairly determined not to use one, and certainly not in the field. This does restrict our combining throughput to a certain extent, but it also means that we have to limit the width of our header. Our bulkiest crop is confection sunflowers so we have to stick to a 20’ head for that as they yield an average of 130 – 150 bu/ac. in a good year. We have built a removable extension to the grain tank on our Cat Lexion combine so that we can handle this volume of sunflowers without having to have any trucks or tractors in the field. Sunflowers only weigh 24 lbs/bu, so we do not use the extension for wheat. This is a heavily built combine but we do not want to take the chance that an axle or wheels could collapse.

So far, we are also seeding the sunflowers and corn with a 20’ planter, but our broadacre crops are seeded with a 30 Flexicoil drill, which means that currently there will be one tramline in the field every 120”. We’d like to improve on this by going to a 12 row planter, from 8 rows, but because we strip-till and deep fertilize with a separate 8-row machine, we would have to extend that as well to 12 rows.

The decision to grow row-crops, aside from their value, was also made in order to handle all the high residue produced on an irrigation farm. Neither of the disc drills we have used (JD 750 style or Barton angled disc) can handle the residue from high yielding wheat, or even canola, and we do not want to bale the residue off the field (which, by coincidence, has made the CTF equipment adaptations easier: no balers or stackers to worry about). By utilizing row-crops, we can use paired (i.e. not single wheel) residue managers and/or cutting discs, to get through any amount of residue.

We started strip-tilling, which was going against the zero-till fundamentalist thinking for two main reasons: 1) long-term zero-till tends to concentrate immobile nutrients (P & K especially) in the top 2-3” of soil, so while strip-tilling we can put any amount of nutrients, in varying rates if required, down to 6-8” deep, and this will be directly below the seed and away from curious weeds. 2) In cool, wet springs our sunflowers and especially corn, were really struggling to germinate and start growing due to residue keeping the soil cold.

Because our airseeder is a single-shoot machine, we have been using one-pass to apply fertilizer down to about 2 ½” deep, as early as we can get into the fields, (which can be well before we’d want to seed them) and then do the seeding pass with some “pop-up” fertilizer. I think with this 2-pass scenario, CTF will be of even more benefit, as the air-carts are very heavy. I did build a 120” axle for the front of the Flexicoil aircart to replace the dual bogey wheel that was there. This could also have been purchased direct from Flexicoil for $7,500 and a 6-month wait.

We have a 90’ pull-type Farm-King sprayer which works well in the broadacre crops, (3 x 30’ passes) but in the sunflowers I was blocking it off to 80’ (4 x 20’ planter passes). Ideally I should move to 120’, but our land is a little rolling and rough so we will have to be careful with that.

The main headache has been the GPS guidance system, going from an Outback S using WAAS, to an S2, to an S2 with a Baseline base-station were all incrementally better, but not good enough for strip-tilling and combining.

The deepening tram-lines may prove to be a problem in the future: if they get too deep, we do have a ditch filler that we used when we had flood irrigation and also used to occasionally fill centre pivot wheel-tracks. Pivot wheel-track filling is only effective if done in the fall, not the spring. There are quite a few used ditch-fillers about at farm auctions, so if we purchased a 2nd one, and built a toolbar to hold the 2 of them, I don’t think it would be a problem filling them in occasionally. A second, partial solution may be to divert all the chaff from the chaff spreader into the tram-lines.

After 2 years of use, I noticed that one of the hubs on my Versatile 4WD has cracked where the axle extensions are bolted on. I’m in the process of gathering some information on what could be done to prevent this happening again. I had originally thought that having new Michelin radial tires would absorb a lot of the shock of bumps in the field, but this front axle carries 6.2 tonnes whilst the total rear axle, with ballast, is only 3.1 tonnes.

Extension Activities

The CTFA program is primarily applied research but we do look for opportunities to inform farmers, agronomists and others of the progress we are making. Our website www.controlledtrafficfarming.org is maintained by our partner the Alberta Canola Producers Commission. It serves as a primary way to provide information on CTF and our plots. We are also on Twitter @ctfalberta, Facebook and YouTube.

Over the last two years we have had field days at each of the sites. Our feature for 2012 was soil pits, looking at infiltration, soil characteristics and rooting. FarmTV produced a video from the Morrin field day http://www.farm.tv/watch.html/747. We partnered with Farmers Edge, one of our partners, for the Lacombe field day. About 143 persons attended the four 2012 field days.

Figure 21. Photos from the 2012 CTFA field days

CTFA has spoken at farm extension meetings, been interviewed for radio and produced several articles for magazines such as TopCrop and Farming for Tomorrow.

Robert Ruwoldt, a CTF/no-till farmer from Australia, toured each of the sites in June 2012. His interactions with farmers proved to be very helpful given Robert's extensive experience with CTF. He also met with three groups of farmers during his tour.

Summary

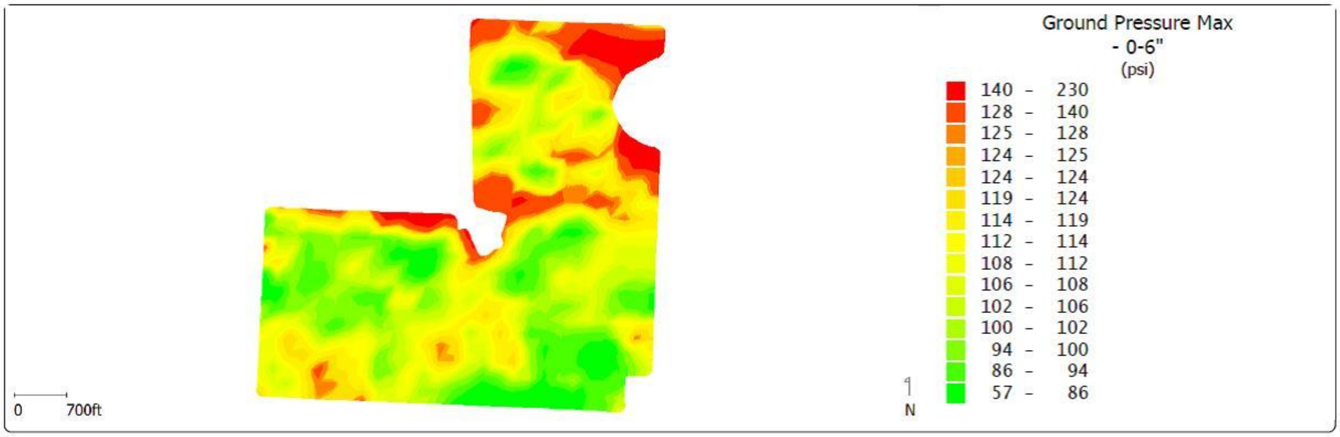
The second year of the Controlled Traffic Farming Alberta project went fairly smoothly as the co-operators gained knowledge of CTF systems and implemented them on their farms. Two years of field data is very limited but we are seeing some early trends such as fuel saving, better infiltrations rates and more efficient operations on the CTF plots. Weed communities have not changed.

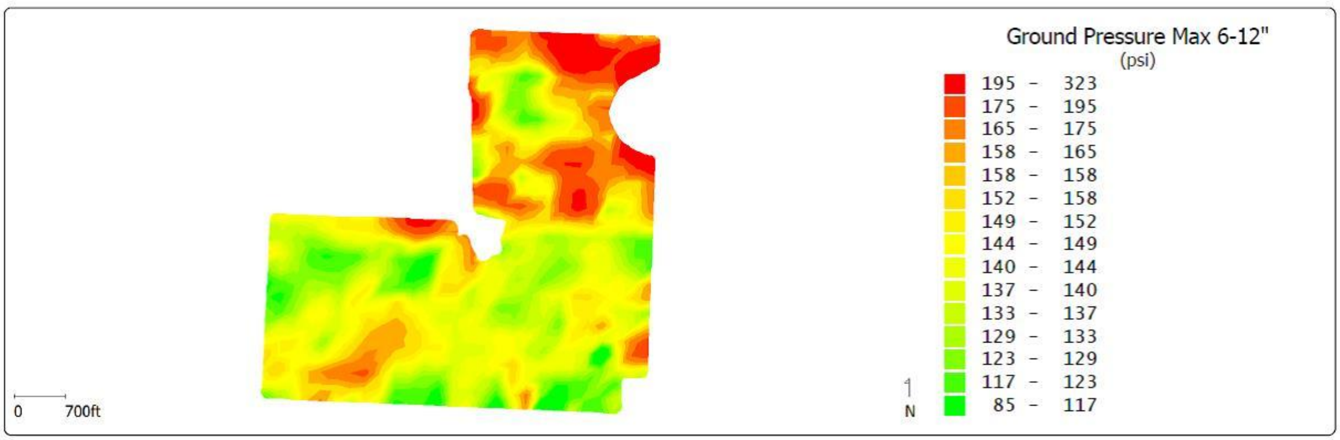
It is too early to tell if yields are significantly different, however the economic data is showing an advantage at three sites for the CTF.

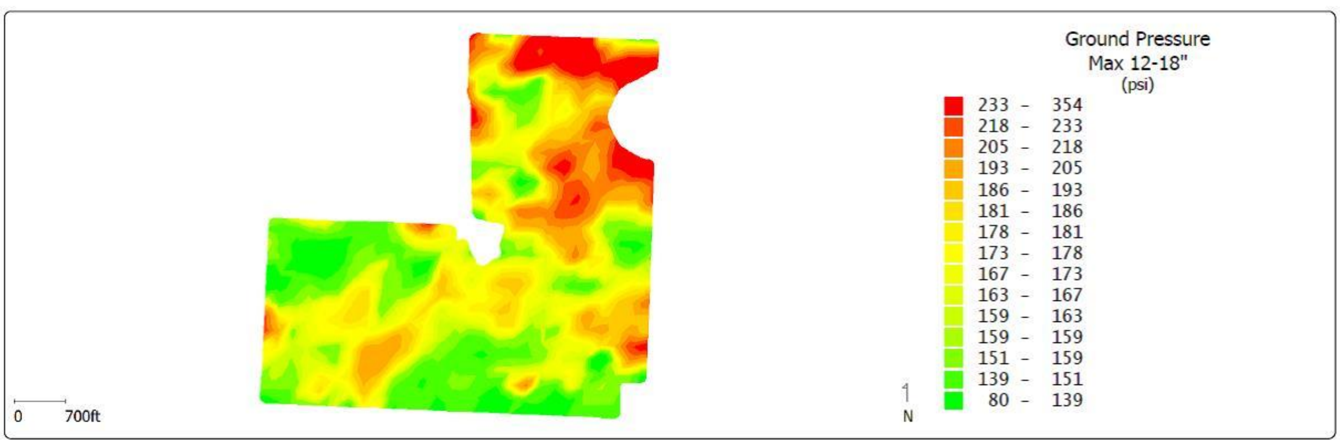
We will continue to measure and record data such as fuel use, water infiltration, weed communities, yield, and costs. Soil properties such as biological life, bulk density and resistance will be measured near the end of the project.

Appendix One – Penetrometer Readings

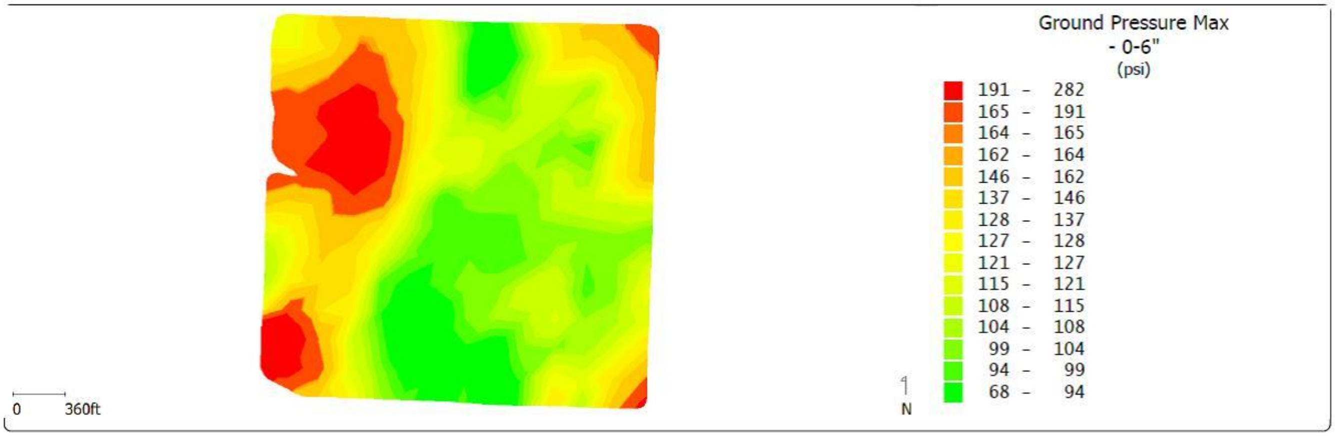
Dapp – Fall 2012 Penetrometer Readings

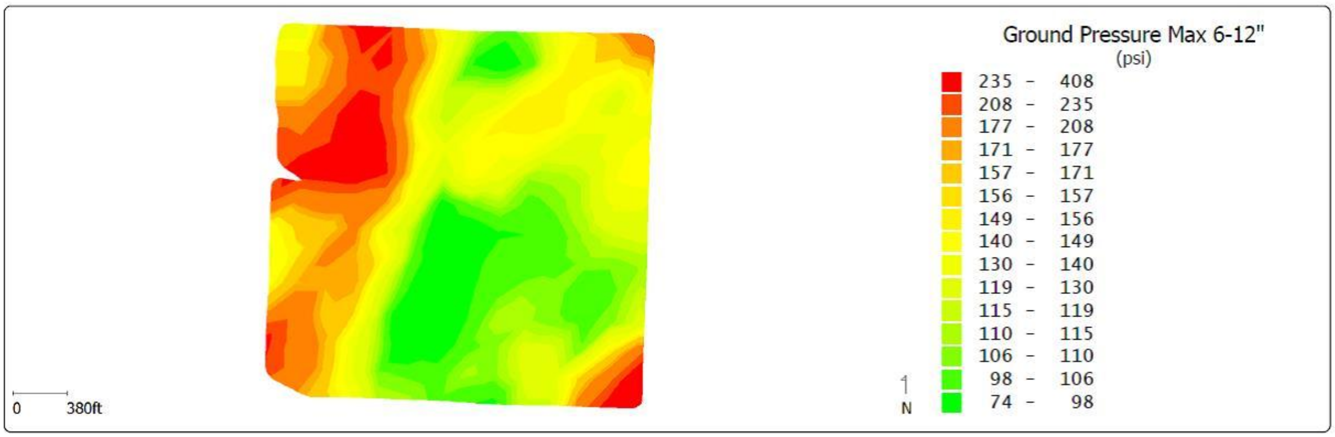


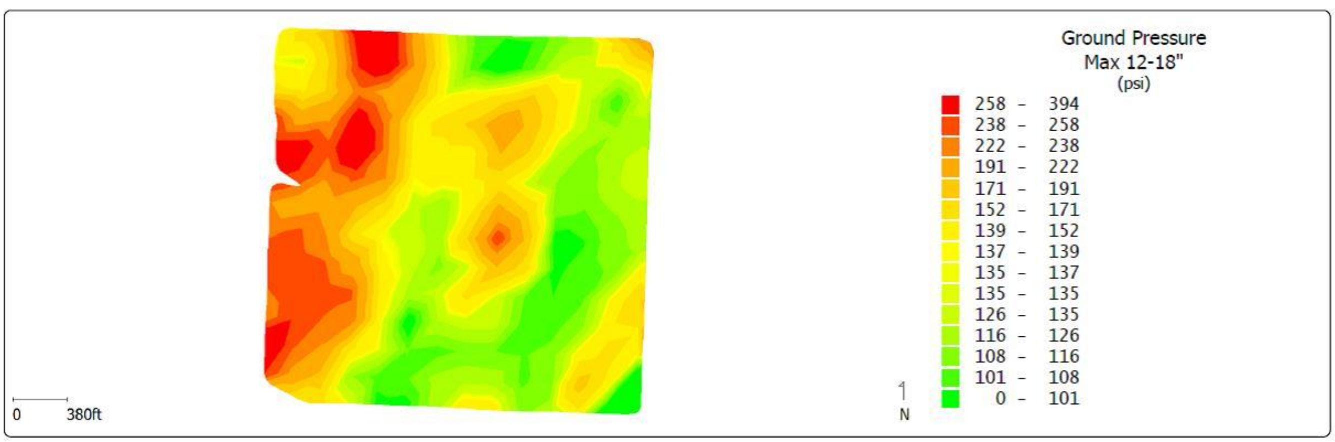




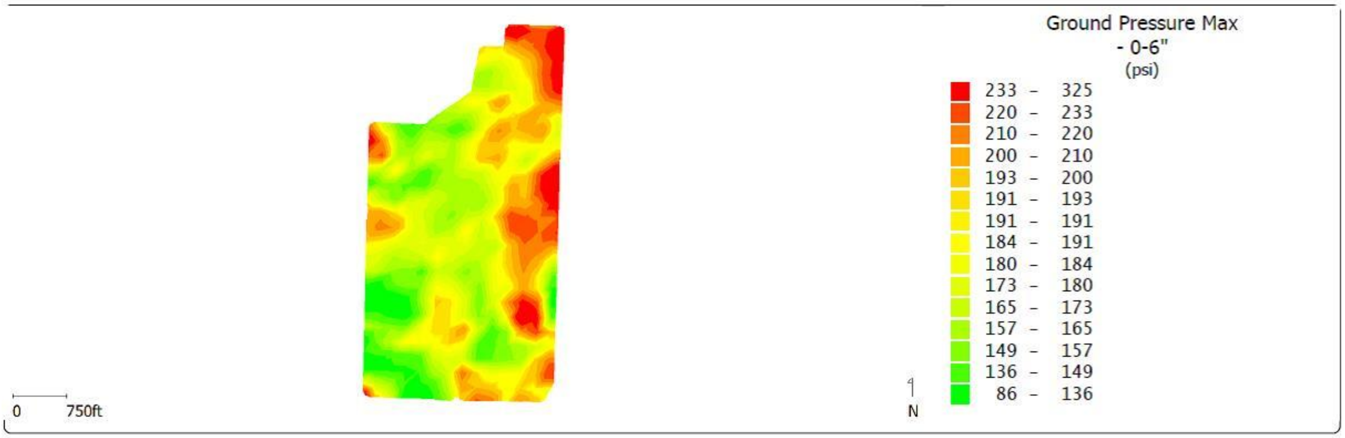
Lacombe – Fall 2012 Penetrometer Readings

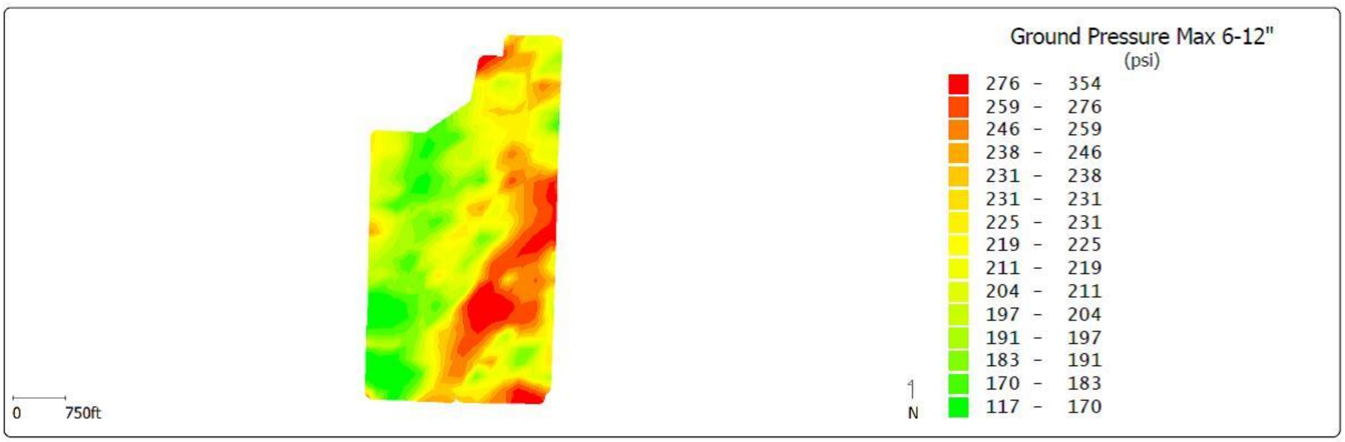


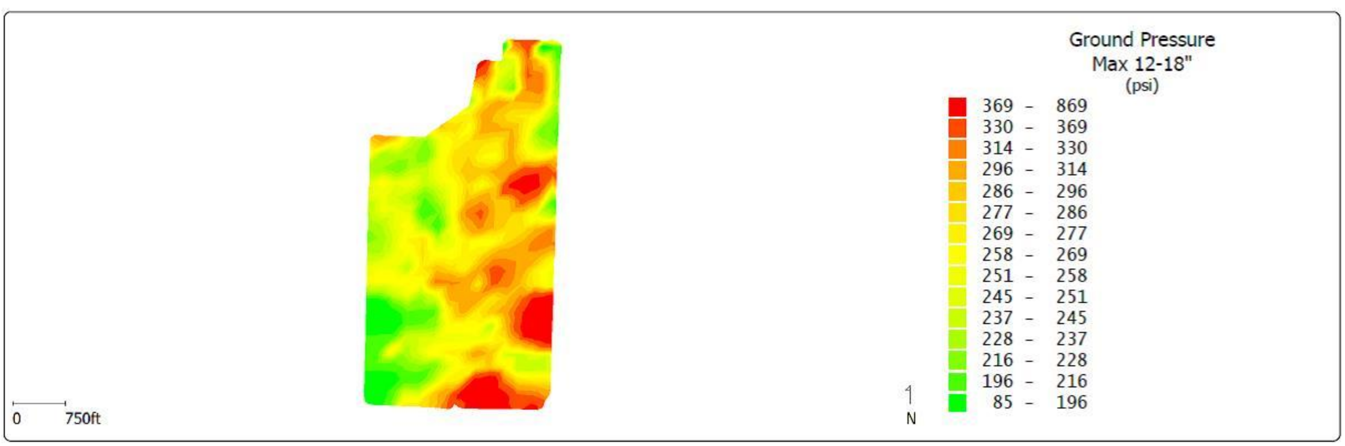




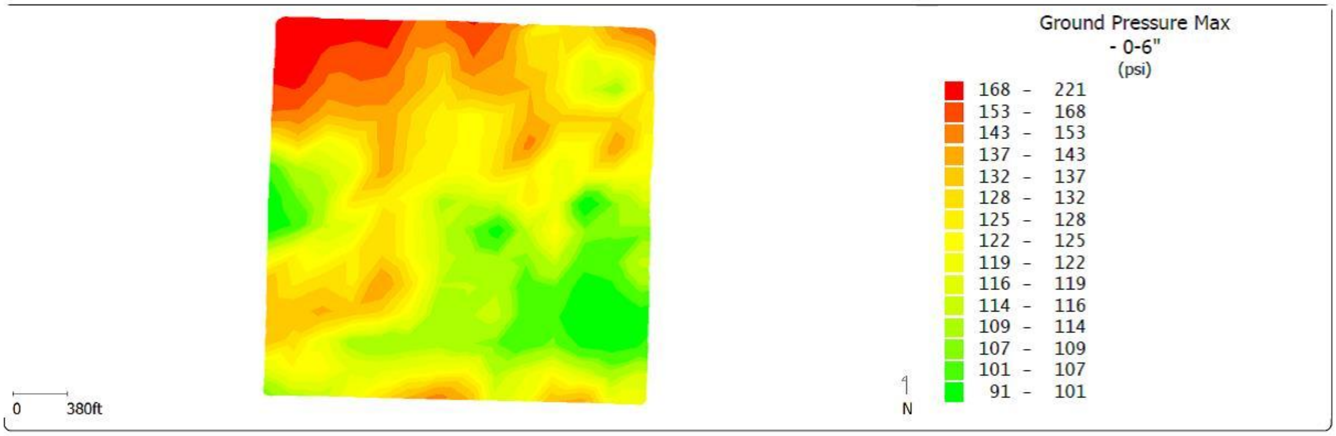
Trochu - Fall 2012 Penetrometer Readings

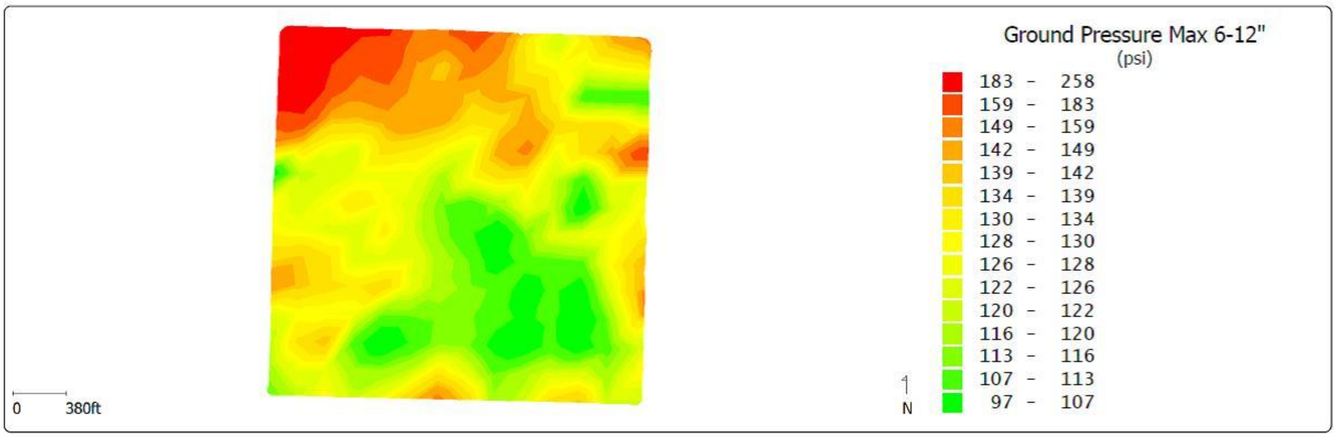


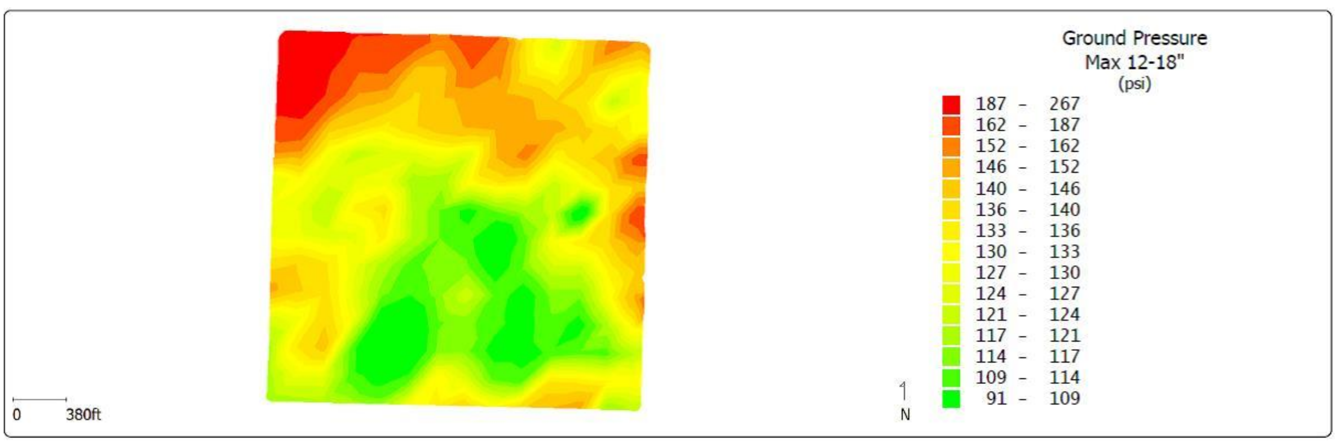




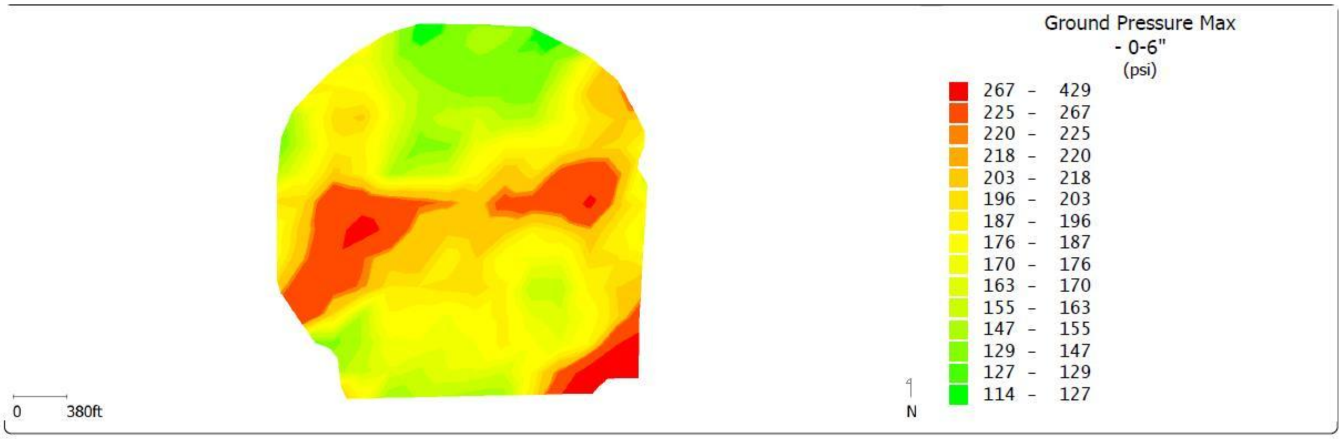
Morrin – Fall 2012 Penetrometer Readings

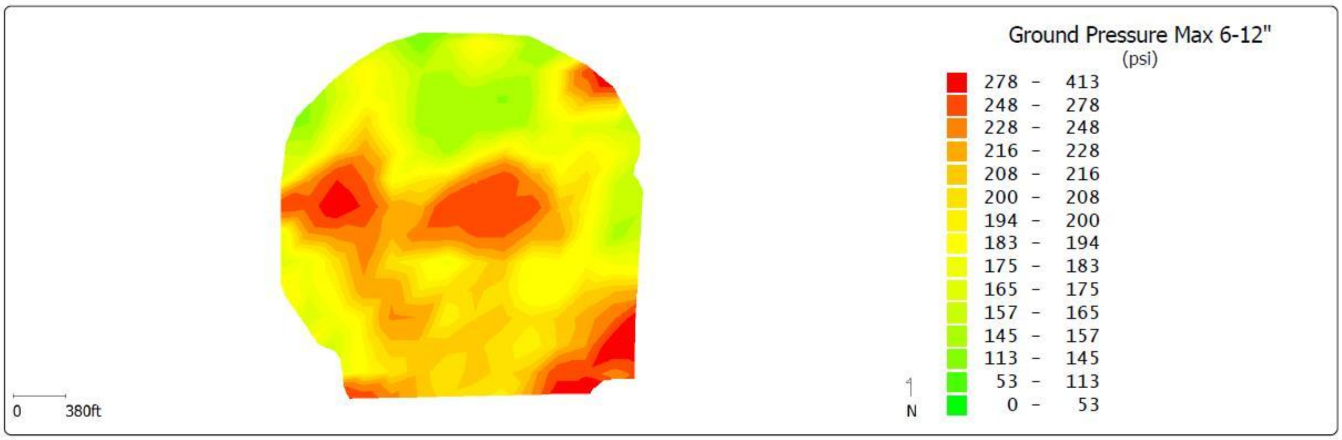


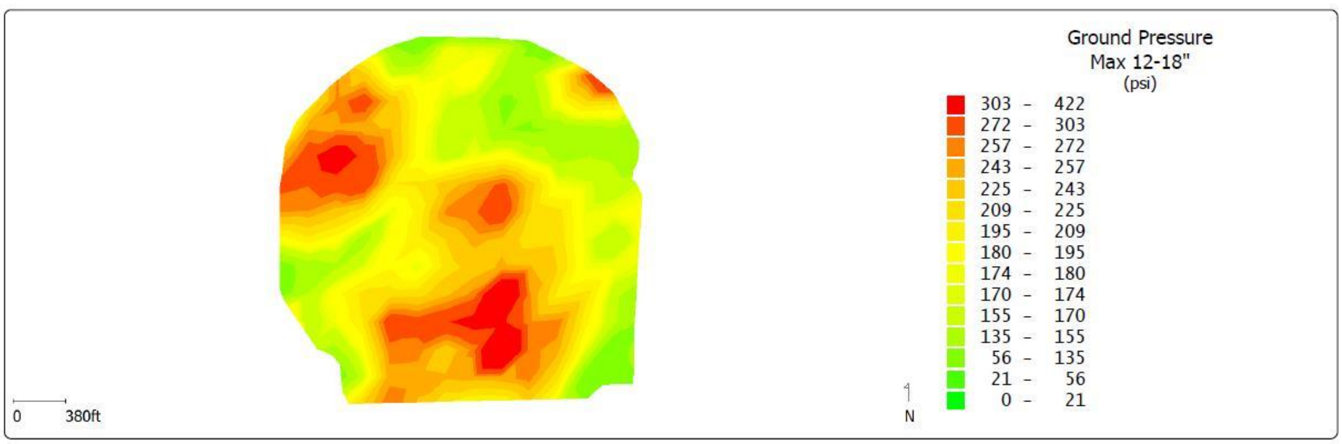




Rolling Hills – Fall 2012 Penetrometer Readings





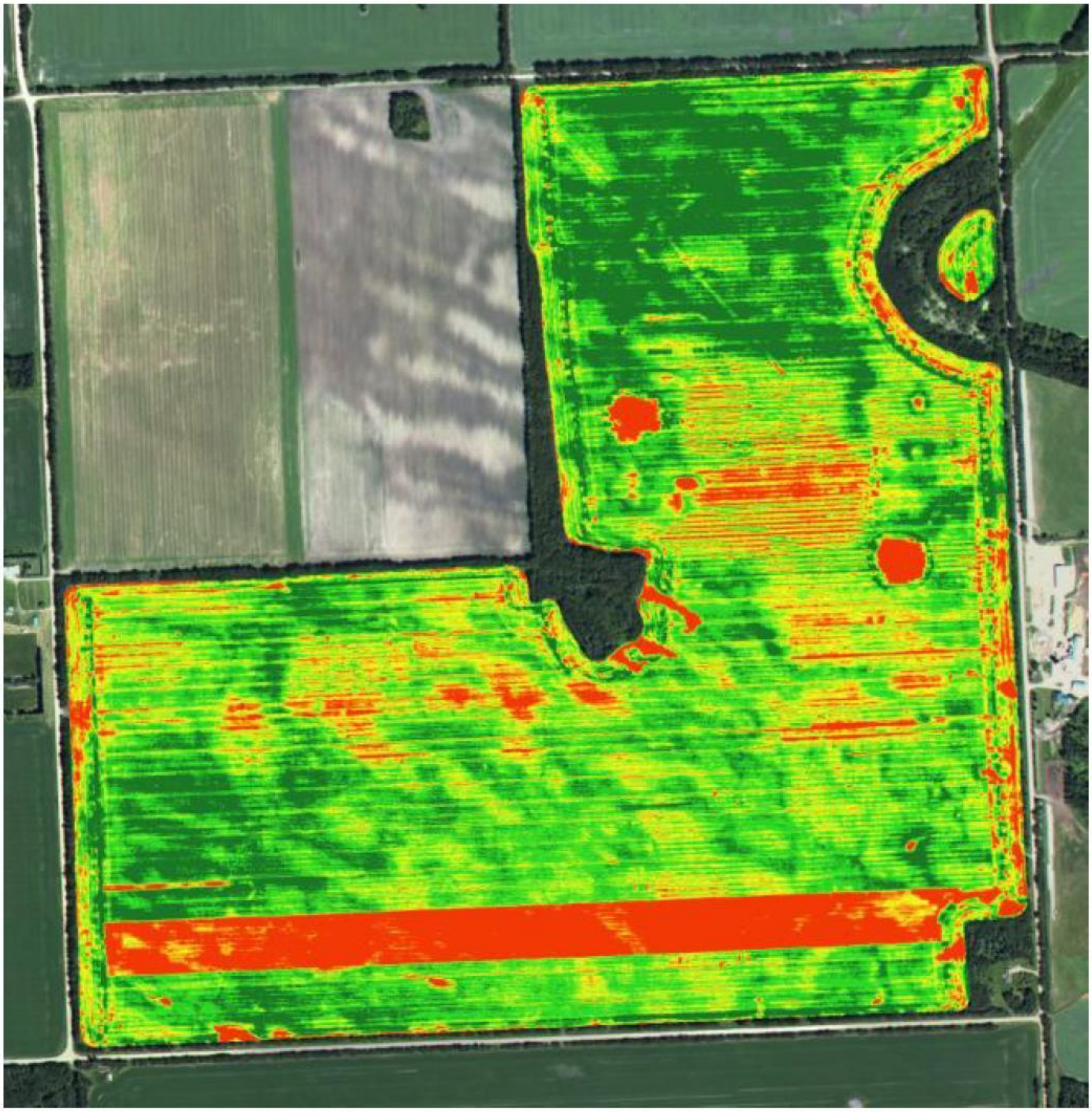


Appendix Two – NDVI Imagery

Field Report

d.branson@fieldtraks.ca

Grower:	Beyond Agronomy	**Fly Date:**	6/30/2012	**Order ID:**	558
Farm:	Cedar Brook	**Acres:**	439.97		
Field:	S_NE_35_62_1 W5	**Image Type:**	NDVI		

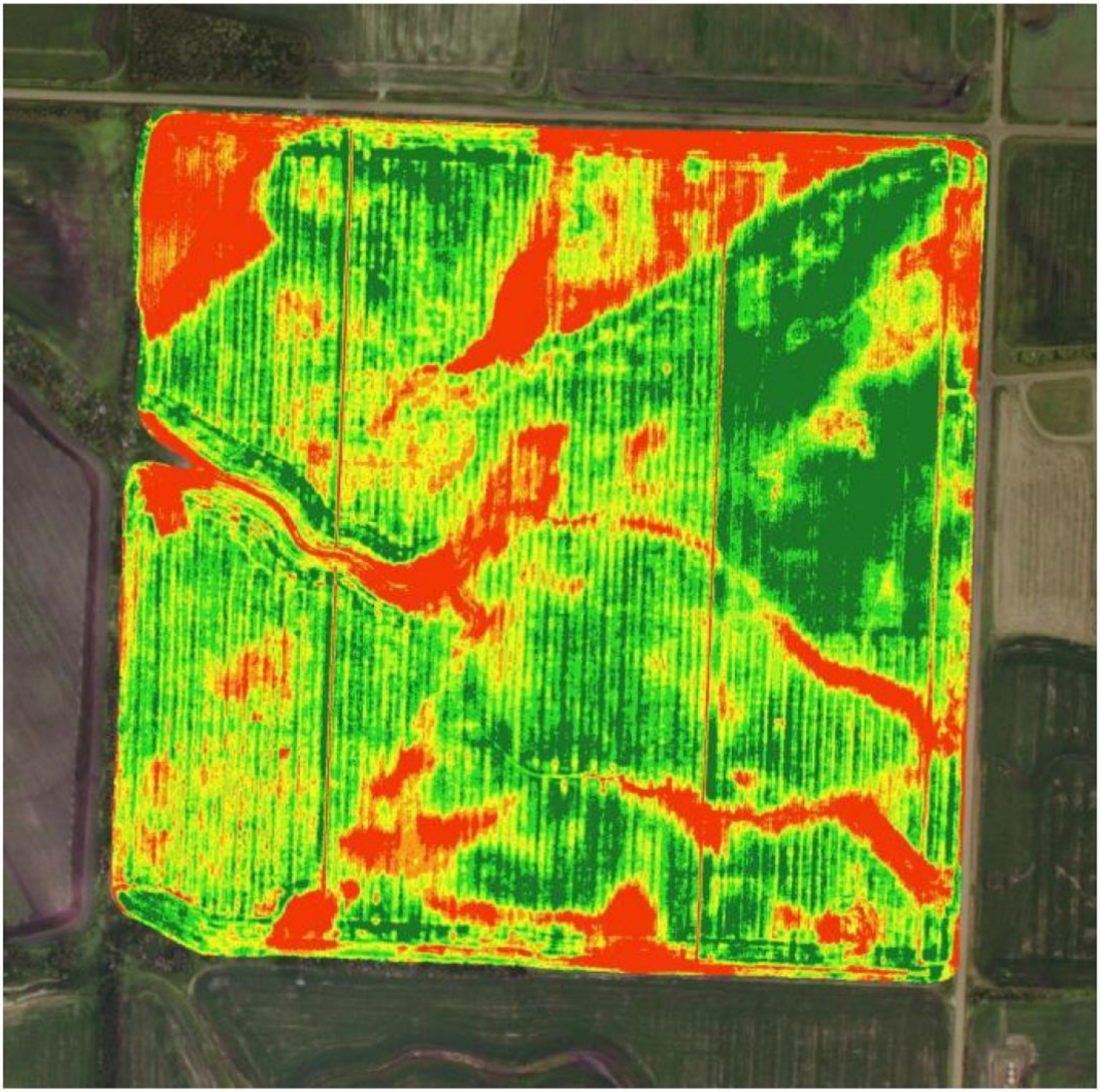


Field Center: 54.4055788013713, -114.037598406905

Field Report

d.branson@fieldtraks.ca

Grower:	Beyond Agronomy	**Fly Date:**	6/25/2012	**Order ID:**	558
Farm:	Durango	**Acres:**	157.64		
Field:	CTF Field 1	**Image Type:**	NDVI		

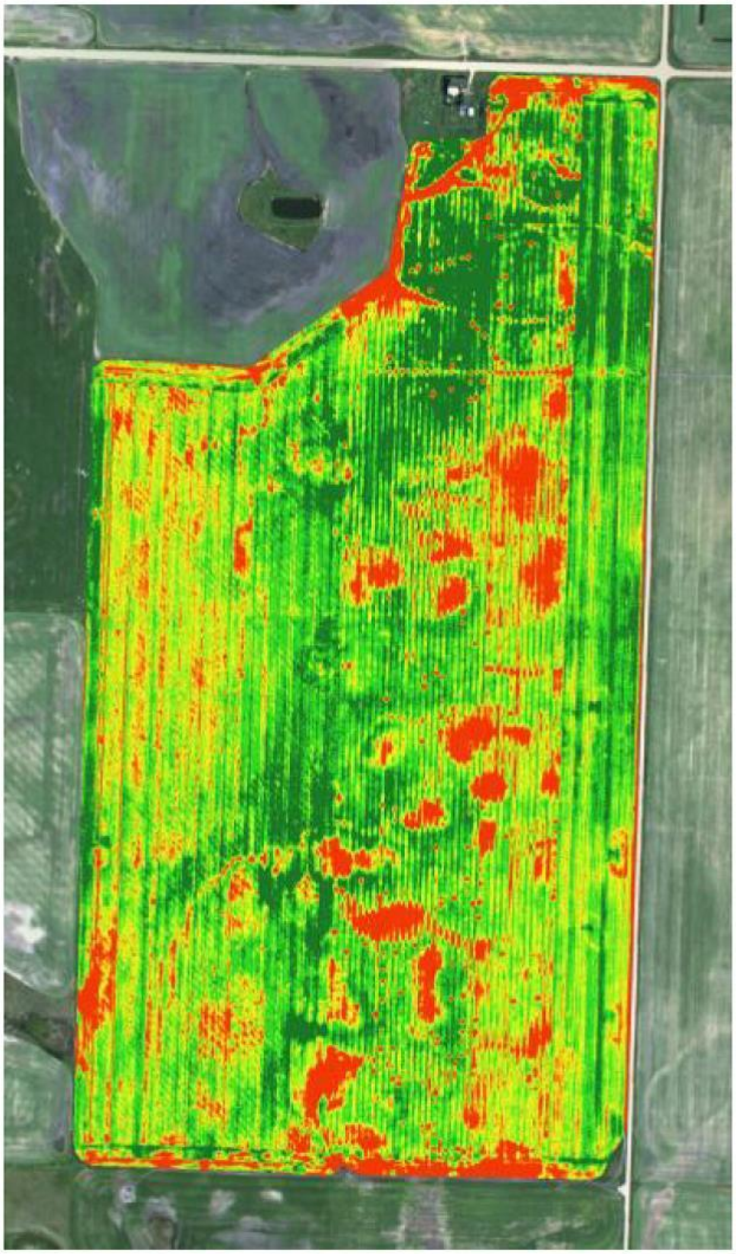


Field Center: 52.488543691573, -113.657342946499

Field Report

d.branson@fieldtraks.ca

Grower:	Beyond Agronomy	**Fly Date:**	6/30/2012	**Order ID:**	558
Farm:	Christie	**Acres:**	274.4		
Field:	Butchart Field 9	**Image Type:**	NDVI		



Field Center: 51.8154201093175, -113.388433899496

Field Report

d.branson@fieldtraks.ca

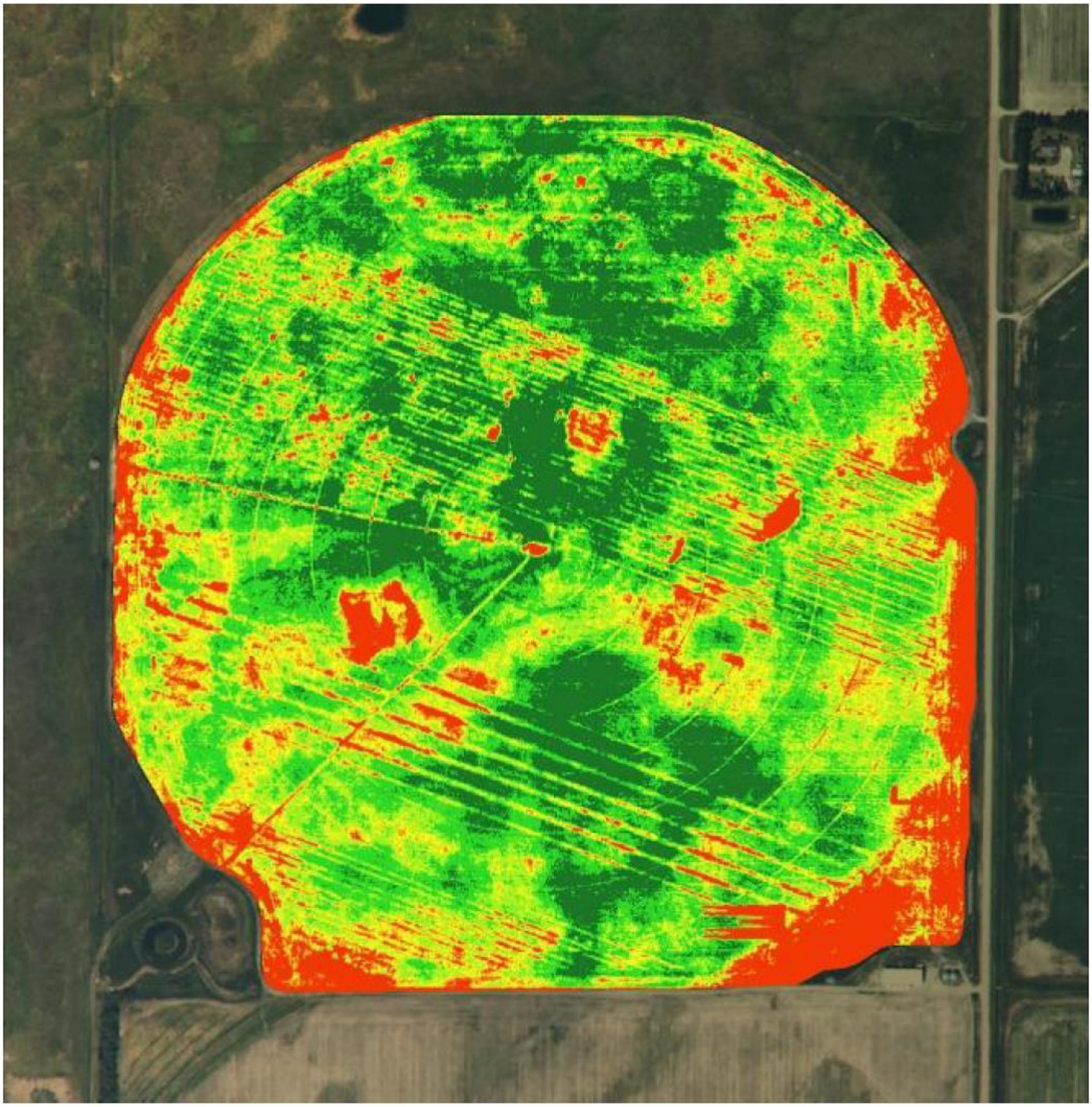
Grower:	Beyond Agronomy	**Fly Date:**	6/28/2012	**Order ID:**	558
Farm:	Larcur	**Acres:**	160.94		
Field:	NE_20_31_20_4W_Z_03	**Image Type:**	NDVI		

Field Center: 51.6742646944027, -112.798475071364

Field Report

d.branson@fieldtraks.ca

Grower:	Beyond Agronomy	**Fly Date:**	7/2/2012	**Order ID:**	560
Farm:	Gary MacLagan	**Acres:**	137.13		
Field:	NE 18 14 13 W4	**Image Type:**	NDVI		



Field Center: 50.1753674230151, -111.761453720265

Appendix Three - Weed Communities

Field 1 - check (S 1/2 35 62 1 W5)

0.5m2 quadrat	CROP wheat	volunteer canola	wild oats	chickweed	shepherd's purse	field horsetail	hempnettle	stinkweed	smartweed	sow thistle	cleavers	wild buckwheat	wild mustard
Quadrat 1	139	172		79		4	1						
Quadrat 2	101	305		70			8					3	
Quadrat 3	127	199		56			33				35	18	
Quadrat 4	127	167		45			1						
Quadrat 5	113	509		118							1	1	
Quadrat 6	106	536		154									
Quadrat 7	87	428		59	11		26	1			1	1	
Quadrat 8	127	156		29			4						1
Quadrat 9	148	38	5	68			29			1	1		

Field 2 - CTF (NE 1/4 35 62 1 W5)

0.5m2 quadrat	CROP wheat	volunteer canola	wild oats	chickweed	shepherd's purse	field horsetail	hempnettle	stinkweed	smartweed	sow thistle	cleavers	wild buckwheat	wild mustard
Quadrat 10	128	61		2			14						
Quadrat 11	107	381		47			2				1		
Quadrat 12	116	290		44	1								
Quadrat 13	113	199	2								1		
Quadrat 14	115	212	13	26			1				1		
Quadrat 15	132	275	1	20			3						
Quadrat 16	117	395		57	1		6						
Quadrat 17	132	108	8									1	
Quadrat 18	125	193		3						2	1	1	

Notes:

- Counted 2 rows of crop each time (0.71 m x 2 rows)
- Check wheat was ~2L, while CTF wheat was a bit further along (2-3L)
- There seemed to be more trash in the quadrats in the CTF
- There was Avadex put on some of the field, but we tried to stay in the area with Avadex so that we were comparing the same thing in both the Check & CTF

LACOMBE - Craig Shaw

Spring 2012

Field 1 - check

0.5m2 quadrat	CROP barley	wild oats	canola	chickweed	cleavers	shepherd's purse	hemp nettle	sow thistle	wild buckwheat	dandelion	wheat	Canada Thistle	storksbill	?? (tree?)
Quadrat 1	108		1				1							
Quadrat 2	69	1				1	2					1		
Quadrat 3	97			80		2			1					
Quadrat 4	84			10								1		
Quadrat 5	80		1	35										
Quadrat 6	110			14	2									
Quadrat 7	83			34							2			
Quadrat 8	66			2		1					1			
Quadrat 9	67													

Field 2 - CTF

0.5m2 quadrat	CROP barley	wild oats	canola	chickweed	cleavers	shepherd's purse	hemp nettle	sow thistle	wild buckwheat	dandelion	wheat	Canada Thistle	storksbill	?? (tree?)
Quadrat 10	90			1			2				1			
Quadrat 11	96			2			1				1			
Quadrat 12	106			3							1		2	
Quadrat 13	92			4			1							
Quadrat 14	94		1	64										
Quadrat 15	103			9										
Quadrat 16	112			40			1					1		1
Quadrat 17	103		2	4										
Quadrat 18	83		1											

Notes:

- Counted 2 rows of crop each time (0.71 m x 2 rows)

TROCHU - James Christie

Spring 2012

Field 1 - check

0.5m2 quadrat	CROP barley	canola	shepherd's purse	stinkweed	sow thistle	wild buckwheat	dandelion	foxtail barley	barley	vetch	Canada Thistle	pansy	absinth wormwood	lambsquarters
Quadrat 1	56	15			3							3		
Quadrat 2	58	19			3							2		
Quadrat 3	56	27			14									
Quadrat 4	62	25										1		
Quadrat 5	36	29			25							1		
Quadrat 6	53	14			9							7		
Quadrat 7	60	18			3						5			
Quadrat 8	79	50			2									
Quadrat 9	83	35			4							1		

Field 2 - CTF

0.5m2 quadrat	CROP barley	canola	shepherd's purse	stinkweed	sow thistle	wild buckwheat	dandelion	foxtail barley	barley	vetch	Canada Thistle	pansy	absinth wormwood	lambsquarters
Quadrat 10	95	97			6	1								
Quadrat 11	66	67			13						2			
Quadrat 12	90	63		3	222	1	1				3			
Quadrat 13	81	292			2								1	
Quadrat 14	106	129			22						3			
Quadrat 15	74	190			24						6			
Quadrat 16	82	59			19	1								
Quadrat 17	73	126			21						2			
Quadrat 18	95	74			6						2			4

Notes:

- Check had smaller barley plants with less weeds (1-3 leaf)
- CTF - barley plants were larger (4L, 1-2T) with more weeds, although it looked like most weeds were set back by the burnoff
- Counted 2 rows of crop each time (0.71 m x 2 rows)

ROLLING HILLS - Garry MacLagan

Field 1 - check

0.5m2 quadrat	CROP winter wheat	wild oats	canola	chickweed	cleavers	shepherd's purse	hemp nettle	sow thistle	wild buckwheat	dandelion	barley	Canada Thistle	storksbill	lambs quarters	foxtail barley	black medic/ clover?	stinkweed	flixweed	ladys thumb
Quadrat 10	168							5						1	1				
Quadrat 11	155							9											
Quadrat 12	129							5		2				3			11		
Quadrat 13	124							2						1					
Quadrat 14	135																12		4
Quadrat 15	124							5						1					
Quadrat 16	135							1									1		1
Quadrat 17	195									3							4		
Quadrat 18	200																2	3	

Field 2 - CTF

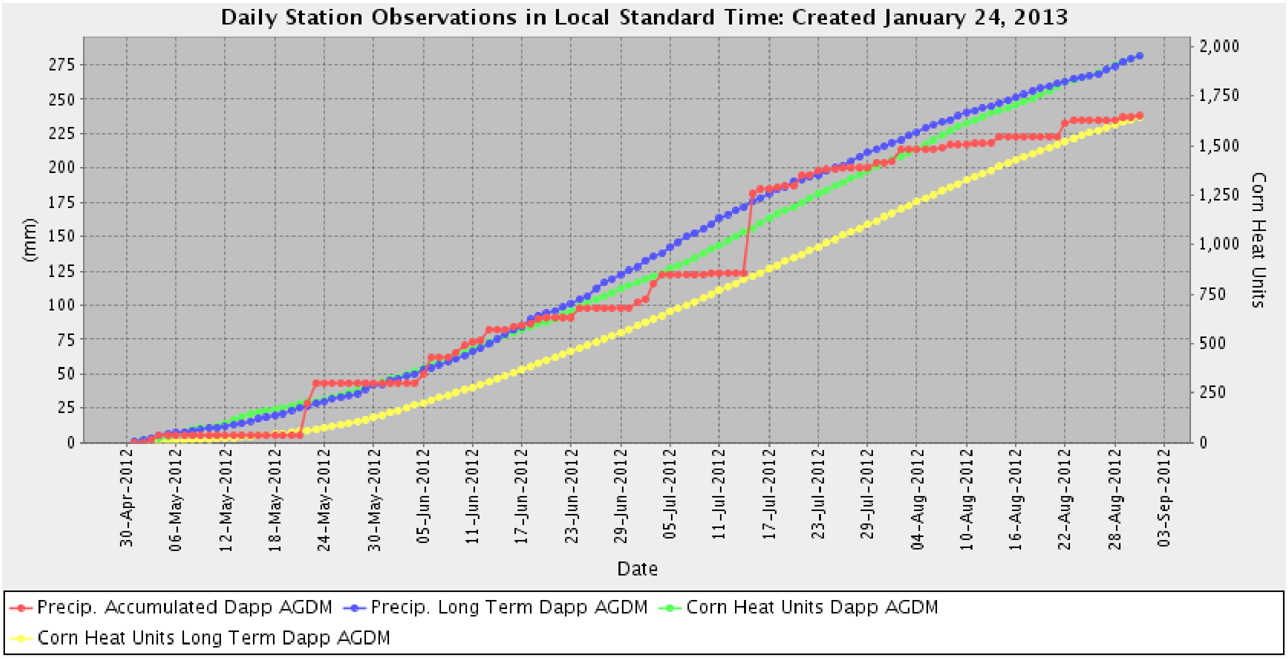
0.5m2 quadrat	CROP winter wheat	wild oats	canola	chickweed	cleavers	shepherd's purse	hemp nettle	sow thistle	wild buckwheat	dandelion	barley	Canada Thistle	storksbill	lambs quarters	foxtail barley	black medic/ clover?	stinkweed	flixweed	ladys thumb
Quadrat 1	102													1					
Quadrat 2	102							15		1				1	1				
Quadrat 3	144													10		1			
Quadrat 4	147																1		
Quadrat 5	112																		
Quadrat 6	111																		
Quadrat 7	129							1										20	
Quadrat 8	132																4		
Quadrat 9	154																	1	

Notes:

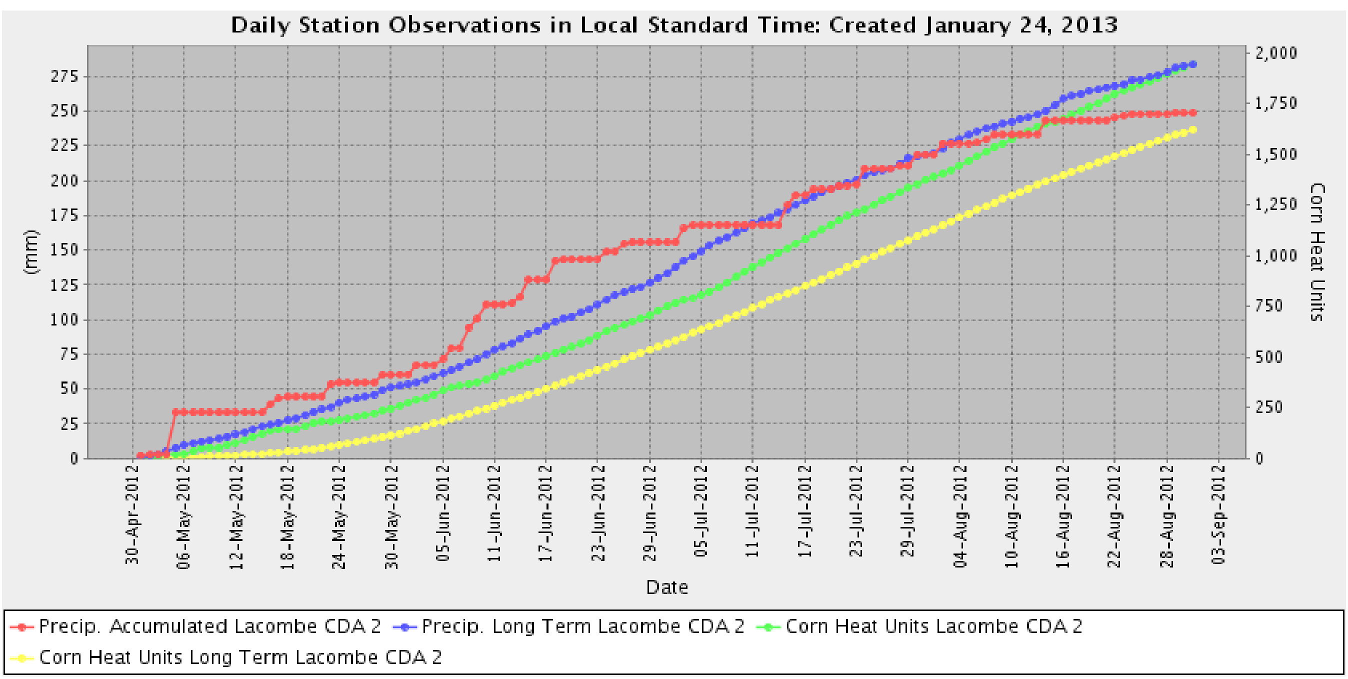
1. Counted 3 rows of crop by 0.71 m (row spacing is 7.5")
2. Counted the CTF side first (noticed that there were strips going across the field where the wheat was a different color (was at a 45 degree angle to the seeding rows) - all the counts were done in the dark green sections of wheat
3. When we counted the check, we noticed that the bottom leaves were brown; we did not notice any brown leaves when counting the CTF
4. Winter wheat stage was 1 node (just after canopy closure)
5. CTF field was the north side; check was closer to the green hay barn, and imbetween the 2 flags marking the field (right beside the green hay barn is a small stip of CTF)

Appendix Four – Climate/Weather Data

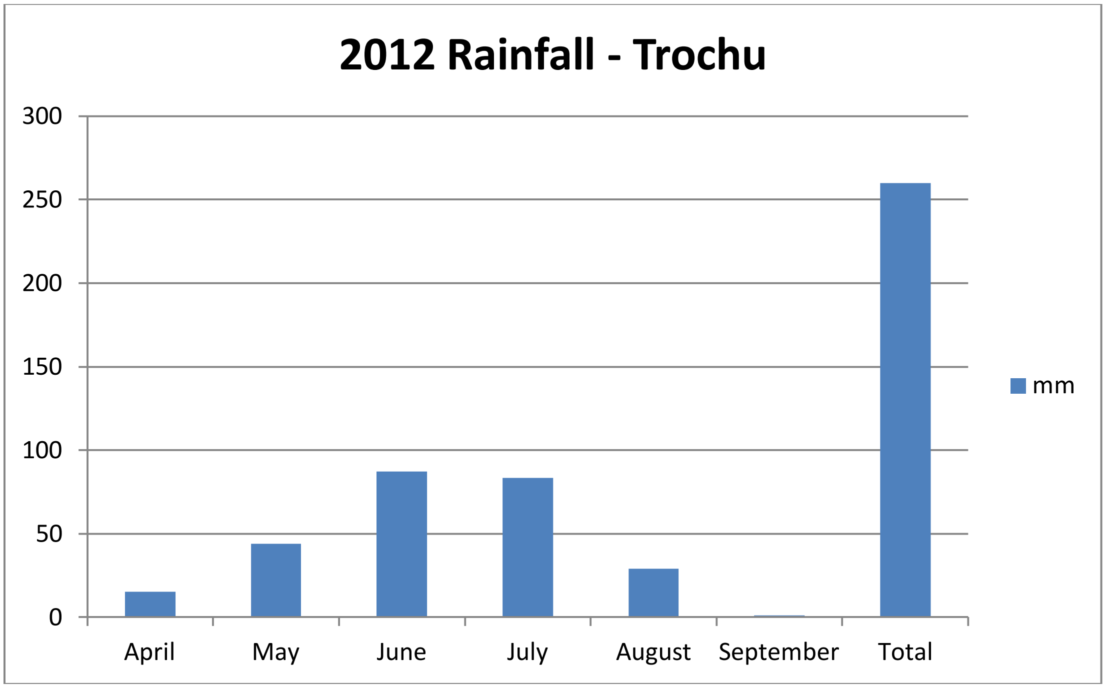
Dapp, Alberta Agriculture Weather Station data



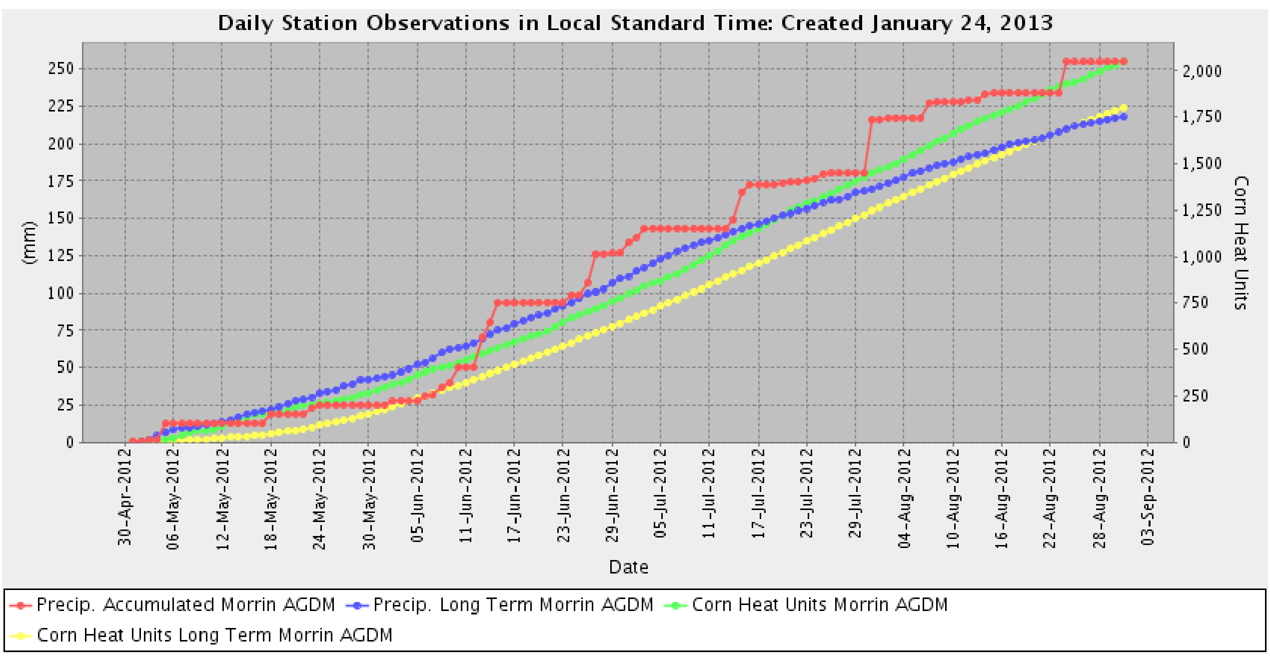
Lacombe CDA Weather Station data



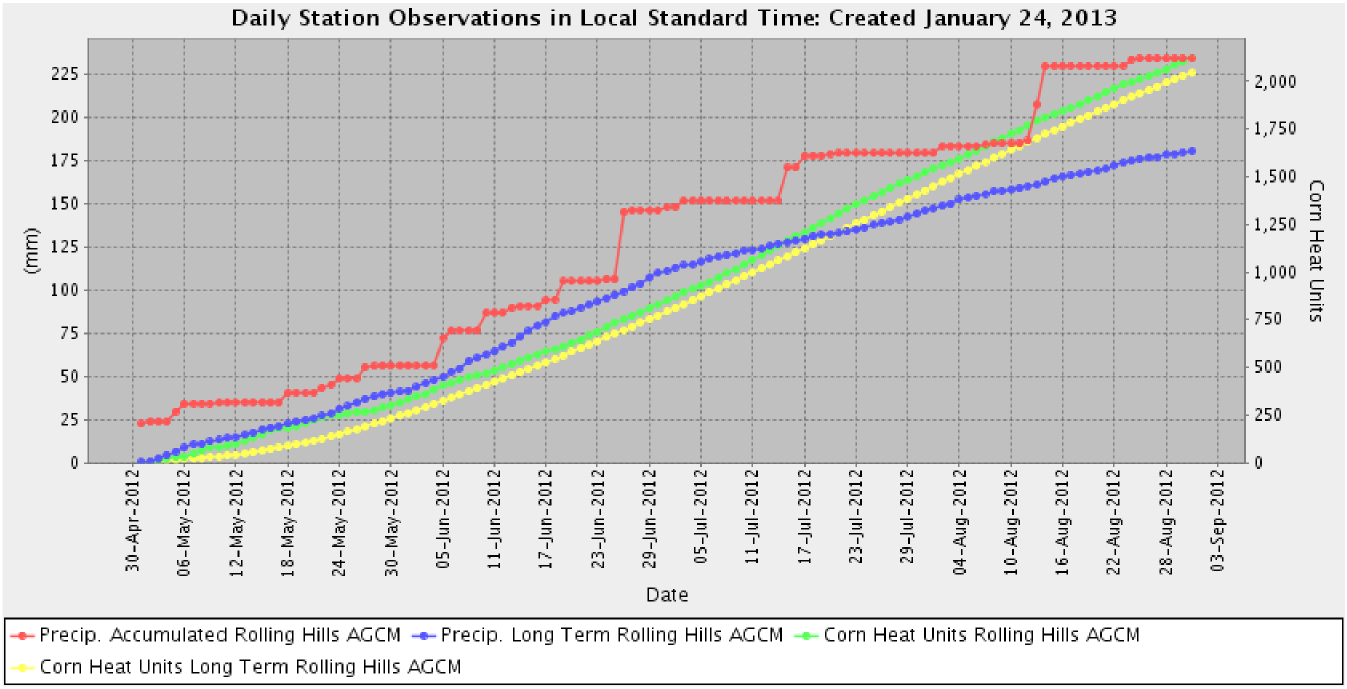
Trochu Rainfall data from Alberta Agriculture, Lacombe



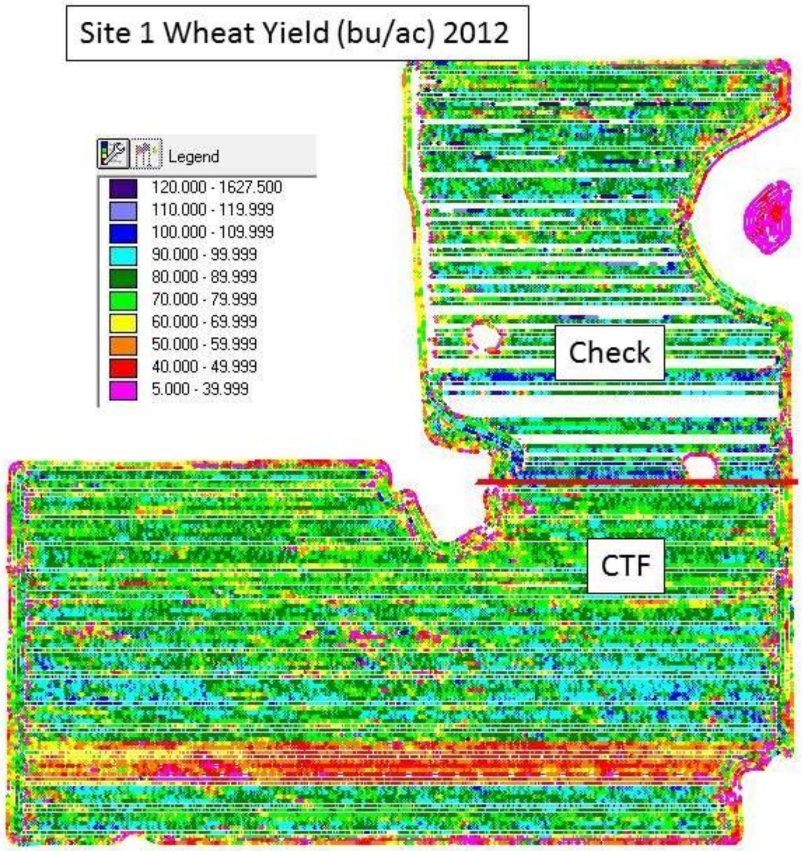
Morrin, Alberta Agriculture Weather Station data

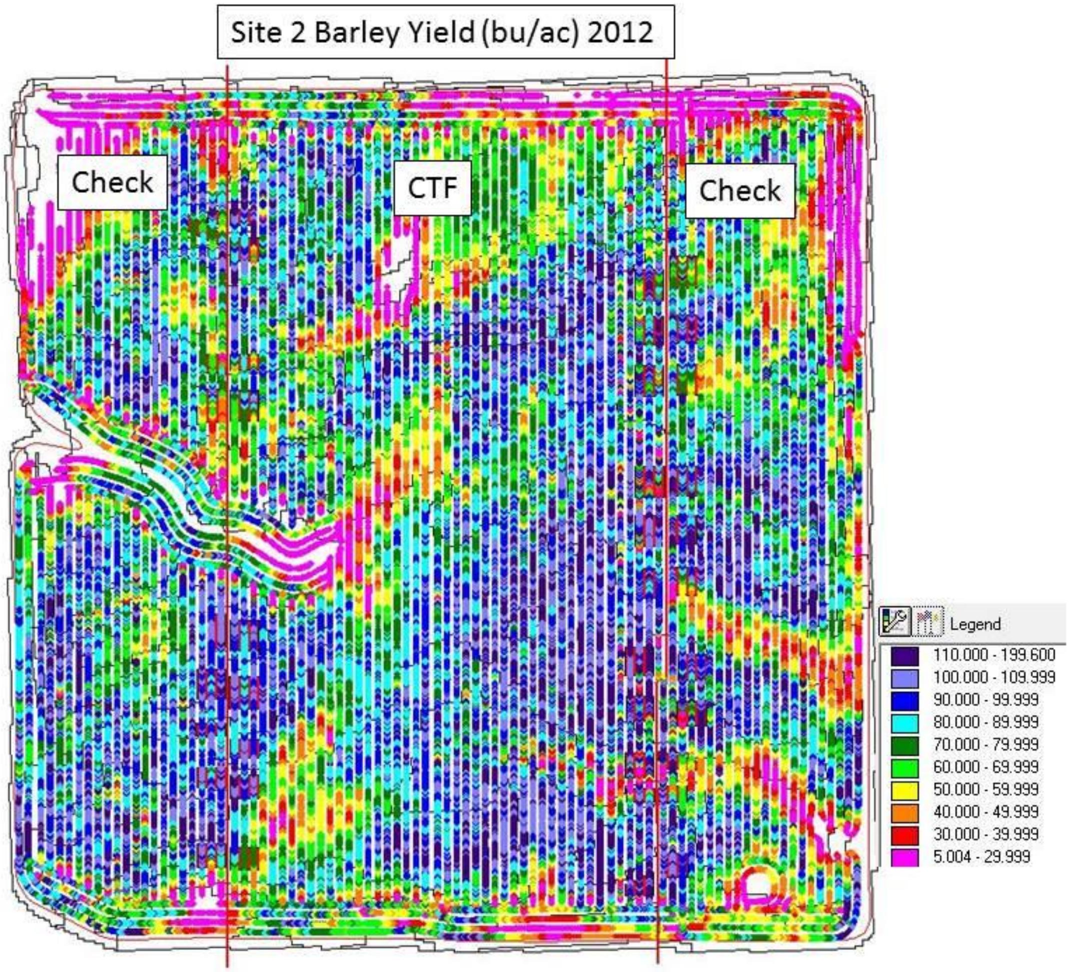


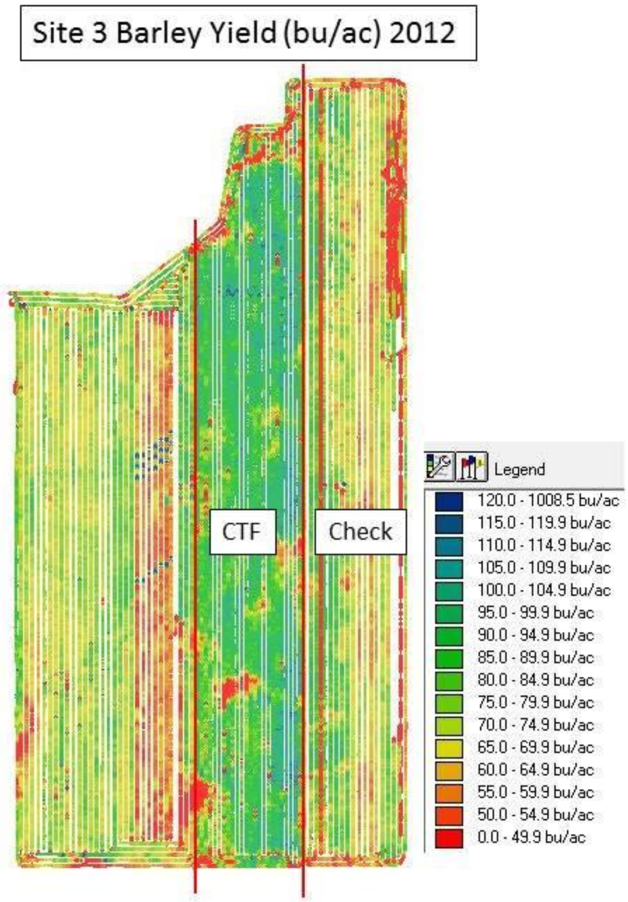
Rolling Hills, Alberta Agriculture Weather Station data



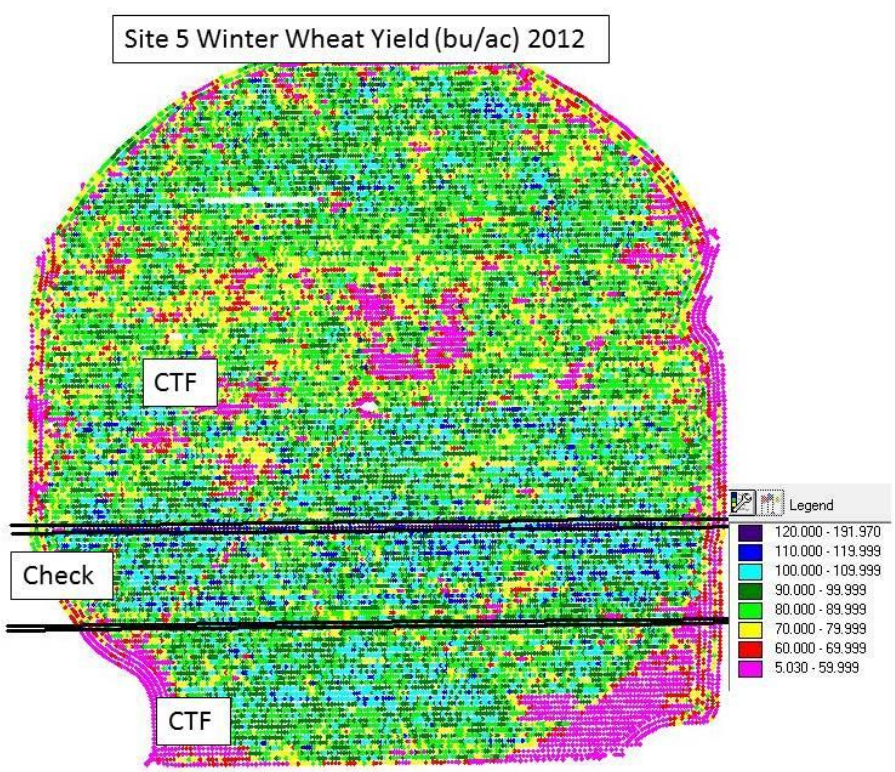
Appendix Five – Yield Maps




Site 2 Barley Yield (bu/ac) 2012
Check
CTF
Check
Legend
110.000 - 199.600
100.000 - 109.999
90.000 - 99.999
80.000 - 89.999
70.000 - 79.999
60.000 - 69.999
50.000 - 59.999
40.000 - 49.999
30.000 - 39.999
5.004 - 29.999



Site 3 Barley Yield (bu/ac) 2012
CTF
Check
Legend
120.0 - 1008.5 bu/ac
115.0 - 119.9 bu/ac
110.0 - 114.9 bu/ac
105.0 - 109.9 bu/ac
100.0 - 104.9 bu/ac
95.0 - 99.9 bu/ac
90.0 - 94.9 bu/ac
85.0 - 89.9 bu/ac
80.0 - 84.9 bu/ac
75.0 - 79.9 bu/ac
70.0 - 74.9 bu/ac
65.0 - 69.9 bu/ac
60.0 - 64.9 bu/ac
55.0 - 59.9 bu/ac
50.0 - 54.9 bu/ac
0.0 - 49.9 bu/ac



Site 5 Winter Wheat Yield (bu/ac) 2012
CTF
Check
CTF
Legend
120.000 - 191.970
110.000 - 119.999
100.000 - 109.999
90.000 - 99.999
80.000 - 89.999
70.000 - 79.999
60.000 - 69.999
5.030 - 59.999