



Saskatchewan
Ministry of
Agriculture

Soil Fertility for Saskatchewan Irrigation

Irrigation Crop Diversification Corporation

Saskatoon Inn

January 11, 2013

Gary Kruger P Ag CCA
Irrigation Agrologist



Irrigation Crop Diversification Corporation



Irrigation Crop Diversification Corporation

- Statute I-14.1 Irrigation Act, 1996
- Vision
 - Through innovation, to stimulate and service the development and expansion of sustainable irrigation in Saskatchewan





Irrigation Crop Diversification Corporation

- Objectives

- 1) To research and demonstrate to producers and irrigation districts profitable agronomic practices for irrigated crops

- experiments at CSIDC
- demonstrations in grower fields
- Research and Demonstration Report
- Agronomics and Economics



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ICDC
Research and Demonstration
Program Report
2012

ICDC - Delivering "value for money R&D" to Saskatchewan irrigators

www.irrigationsaskatchewan.com

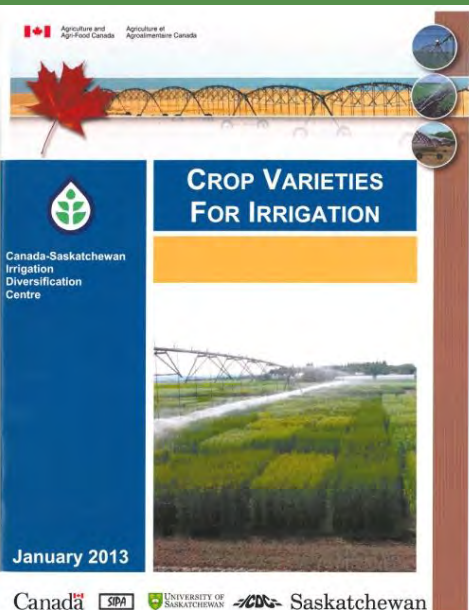




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2) To develop or assist in developing varieties of crops suitable for irrigated conditions

- varietal testing research at CSIDC
- Varieties for Irrigation publication





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Irrigation Crop

Diversification Corporation

3) To provide land, facilities and technical support to researchers to conduct research into irrigation technology, cropping systems, and soil and water conservation measures under irrigation and to provide information to district consumers, irrigation districts and the public

Partner at CSIDC

Reporting at Irrigation District Annual Meeting

The Irrigator publication

ICDC Research and Demonstration Report



ICDC board report 2011
16th Annual Irrigation Conference held in Moose Jaw

The 2011 Annual Meeting of the Irrigation Crop Diversification Corporation (ICDC) was held in Moose Jaw on Dec. 7, 2011.

Staff of the Saskatchewan Ministry of Agriculture's Irrigation Branch provided reports on all the projects implemented and funded by ICDC in 2011.

For those unable to attend the conference, the Conference Proceedings and the ICDC Research and Demonstration Program Reports are available online at www.irrigation.saskatchewan.ca.

The ICDC board said goodbye and thanks to two long-serving members at this year's annual meeting. Neil Stronach of the South Saskatchewan River Irrigation District was a representative for the Lane Development Area (LSDA) and Robert Outhaver of the Mink Creek Irrigation District was a representative of the South West Development Area (SWDA). They have both reached the end of two three-year terms, which made them ineligible to serve in 2011 as ICDC representatives. The board welcomed Jay Anderson of the South Saskatchewan River Irrigation District as a new LSDA representative and Greg Othman of the Mink Creek Irrigation District as a new SWDA representative. The meeting failed to elect a representative from the South East Development Area (SEDA).

The board received approval from the meeting to allocate funds and pursue projects in various categories for the 2012/2013 budget year. The 2011/2012 Work Plan Budget is provided in detail on page 3.

The board is actively involved in trying to meet the needs of ICDC members, and we seek your input into the development of our program.

If you have any ideas for projects or thoughts about the program, please talk to the Irrigation Branch staff listed in this newsletter or to a board representative from your area.

Kevin Plunier, Chairman, ICDC

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4) To co-operate with the Minister in promoting and developing sustainable irrigation in Saskatchewan

Demonstrations at CSIDC – field day

ICDC Agronomics and Economics budget book



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Irrigation Crop Diversification Corporation

- Board of Directors
 - Elected by District Delegates at ICDC annual meeting on prorated basis of irrigated acres
 - represent the four development areas and non-district developments
 - Rep from SK Irrigation Projects Association and SK Ministry of Agriculture



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Ministry Support Staff

- Gerry Gross – Manager
- Sarah Sommerfeld – Forage Specialist
- Rory Cranston – Crop Specialist
- Gary Kruger – SW Projects Agronomist



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ICDC Staff

- Garry Hnatowich – Research Agronomist
– Assisted by CSIDC field staff
- Harvey Joel – Research Technician
- Desiree Ackerman – Administration and
Accounting



Program Overview

- Stand Termination/Tillage Demo
 - Val Marie, Rush Lake, Miry Creek ID
- Annual Forage Cereals Demo – Val Marie
- Soil Fertility Demo on Forages
 - Fall Banded PK Zn– Alfalfa Yield (Miry Creek ID)
 - Spring Band/Broadcast PK – Alfalfa Yield (Chesterfield ID)
 - Fall Broadcast PKS – Alfalfa Yield(Consul)
 - Soil Test vs Traditional Practice on Barley (Eastend)





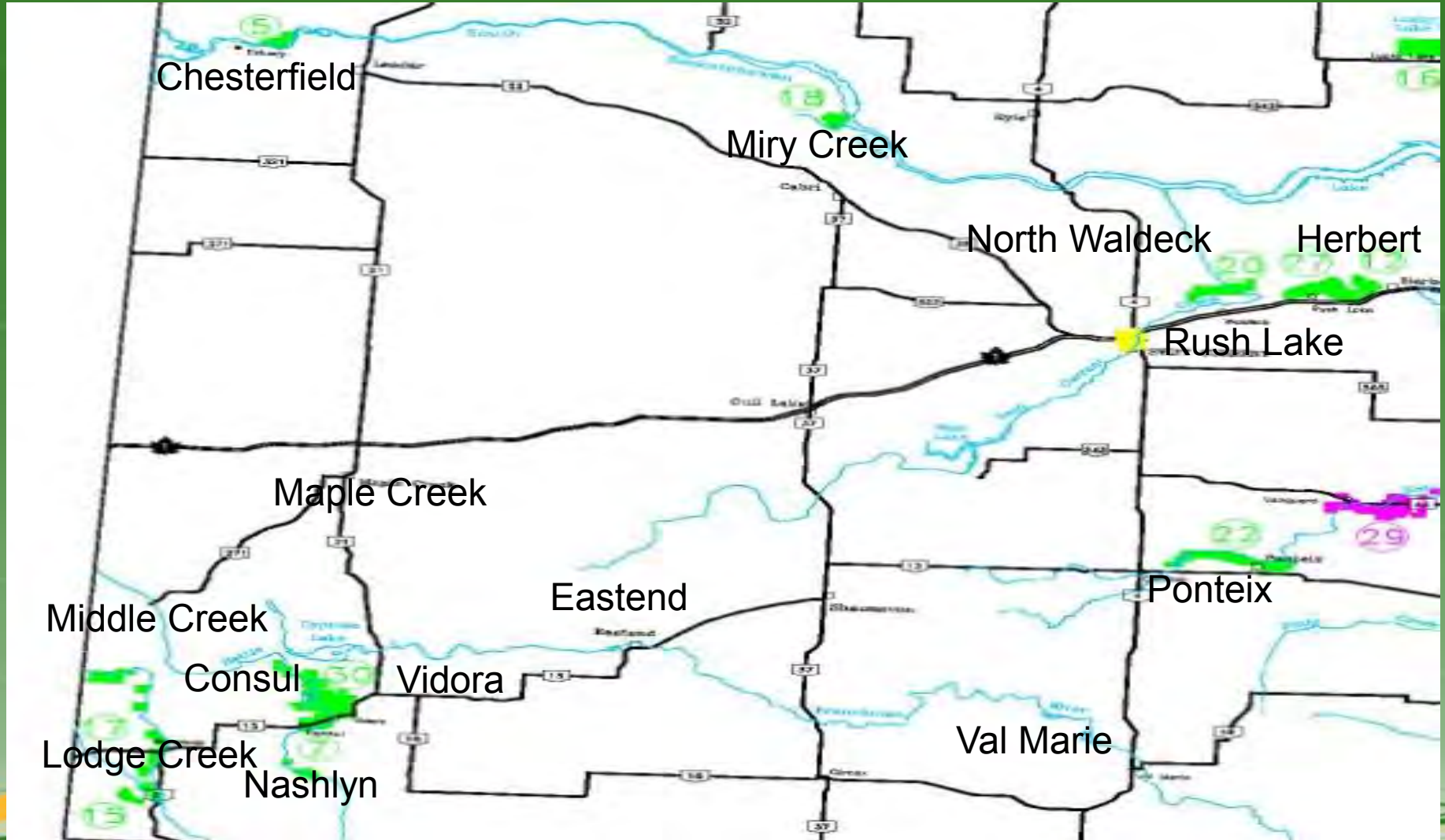
Program Overview

- Irrigated Salt Tolerant Alfalfa Variety Demo (CSIDC)
- Liebig's Law Fertility Demo on Wheat – nutrient seed treatment & N + K (Luck Lake ID)
- Liquid & Granular Phosphate Demo on Canola (SSRID)
- Foliar Copper for Ergot Control on Spring Wheat (SSRID)
- N rate for Oats on Alfalfa Breaking (CSIDC)
- Irrigation Response of Lentil (CSIDC)





Southwest Irrigation Districts





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Gravity Irrigation and Forages



Photo credit: John Linsley



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PK Fertilization of Established Alfalfa Chesterfield Irrigation District

Bill Coventry - Mantario

- Treatments

1) Control

2) P Broadcast

3) P Band

4) K Band

5) PK Broadcast

6) PK Band

Fertilizer application – May 2, 2011



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Chesterfield Irrigation District – Soil Test Results

Grower ID	SAMPLE IDENTIFICATION	ORGANIC MATTER		PHOSPHORUS						NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)				pH	CATION EXCHANGE CAPACITY	PERCENT BASE SATURATION (COMPUTED)								
				P ₁	P ₂	BICARBONATE P	K	Mg	Ca	Na	SOIL BUFFER	C.E.C.	% K			% Mg	% Ca	% H	% Na					
																				WEAK BRAY 1:7	STRONG BRAY 1:7	OLSEN	RATE	RATE
	280085	3.3	M	4	VL	27	M	8	L	92	L	478	VH	2940	H	26		8.1		19.0	1.2	21.0	77.2	0.6

NITRATE-N (FIA)										DTPA EXTRACTION									
Surface			Sub 1			Sub 2			Total	SULFUR S	ZINC Zn	MANGANESE Mn	IRON Fe	COPPER Cu	BORON B	EXCESS LIME RATE	SOLUBLE SALTS 1:1		
ppm	lbs/A	depth IN	ppm	lbs/A	depth IN	ppm	lbs/A	depth IN	lbs/A	ppm	ppm	ppm	ppm	ppm	ppm	mmhos/cm	RATE		
6	11	0-6							11	10	1.7	3	36	1.1	0.6	L	L		

SOIL FERTILITY RECOMMENDATIONS (POUNDS PER ACRE) by MIDWEST LABORATORIES

SAMPLE ID	CROP		YIELD GOAL	SOIL AMENDMENTS				N	P ₂ O ₅	K ₂ O	Mg	S	Zn	Mn	Fe	Cu	B
	INTENDED	PREVIOUS		LIME LBS/A of CaCO ₃	LIME TONS/A 90% ECCE	GYPSUM TONS/A	ELEMENTAL SULFUR LBS/A	NITROGEN	PHOSPHATE	POTASH	MAGNESIUM	SULFUR	ZINC	MANGANESE	IRON	COPPER	BORON
280085	ALFALFA - ton	ALFALFA - ton	4					-	75	180	--	14	0.7	2.8	--	--	1.2
	BARLEY FEED - bu	ALFALFA - ton	100					70	45	40	--	12	0.7	2.5	--	--	--



PK Fertilization of Established Alfalfa Chesterfield Irrigation District

Treatment	Nutrient Applied (lb/ac)	Blend Analysis	Rate of Fertilizer (lb/ac)	2011 1st Cut Hay Yield (ton/ac)	2012 1st Cut Hay Yield (ton/ac)
Control	None	None	None	2.49 ton/ac	2.91 ton/ac
P Broadcast	16-75-0-0	11-52-0	144 lb/ac	3.48 ton/ac	2.58 ton/ac
P Band	16-75-0-0	11-52-0	144 lb/ac	3.29 ton/ac	2.71 ton/ac
K Band	16-0-75-0	10-0-47-0	160 lb/ac	3.40 ton/ac	2.10 ton/ac
PK Broadcast	16-75-75-0	6-28-28-0	270 lb/ac	3.08 ton/ac	2.75 ton/ac
PK Band	16-75-75-0	6-28-28-0	270 lb/ac	3.33 ton/ac	3.03 ton/ac





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PK Fertilization of Established Alfalfa Chesterfield Irrigation District 2012 1st Cut Yields

- Broadcast P vs Band P
2.58 t/ac 2.71 t/ac
- Broadcast PK vs Band PK
2.75 t/ac 3.03 t/ac
- Banding advantage = 0.15 to 0.25 ton/ac



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PK Fertilization of Established Alfalfa

Chesterfield Irrigation District

2012 Pre Bloom Alfalfa Plant Tissue

Treatment	N (%)	P (%)	K (%)	S (%)	Zn (ug/g)	Mn (ug/g)	B (ug/g)
Control	4.4	0.34	2.3	0.33	37	24★	31
P Band	4.2	0.32	1.8★	0.29	29	19★	25★
P Broadcast	4.0	0.32	1.8★	0.30	27	19★	25★
PK Band	3.6★	0.28	1.9★	0.23★	30	32	16★
PK Broadcast	4.4	0.32	2.0	0.31	27	21★	28★
K Band	4.3	0.34	2.5	0.33	34	22★	32
Alfalfa Threshold	2.5	0.25	2.0	0.25	20	25	30
	4.4 X 6.25 = 27.5% Protein						





Manganese



Photo credit: Sarah Sommerfeld

- Symptoms occurred on sandy loam soil with high pH (8.1)
- High pH enhanced in 2012 by above average rainfall
- Low soil test at Miry Creek and Chesterfield
- Low Mn plant tissue test at Chesterfield



Chesterfield June 1 Alfalfa Plant Tissue Sample

Date Received 07-Jun-12

Test Package PM1

N P K S
Cu Fe Mn Zn B

Plant Sample ID 106165

Appearance Healthy

Date Sampled 01-Jun-12

Crop **Alfalfa**

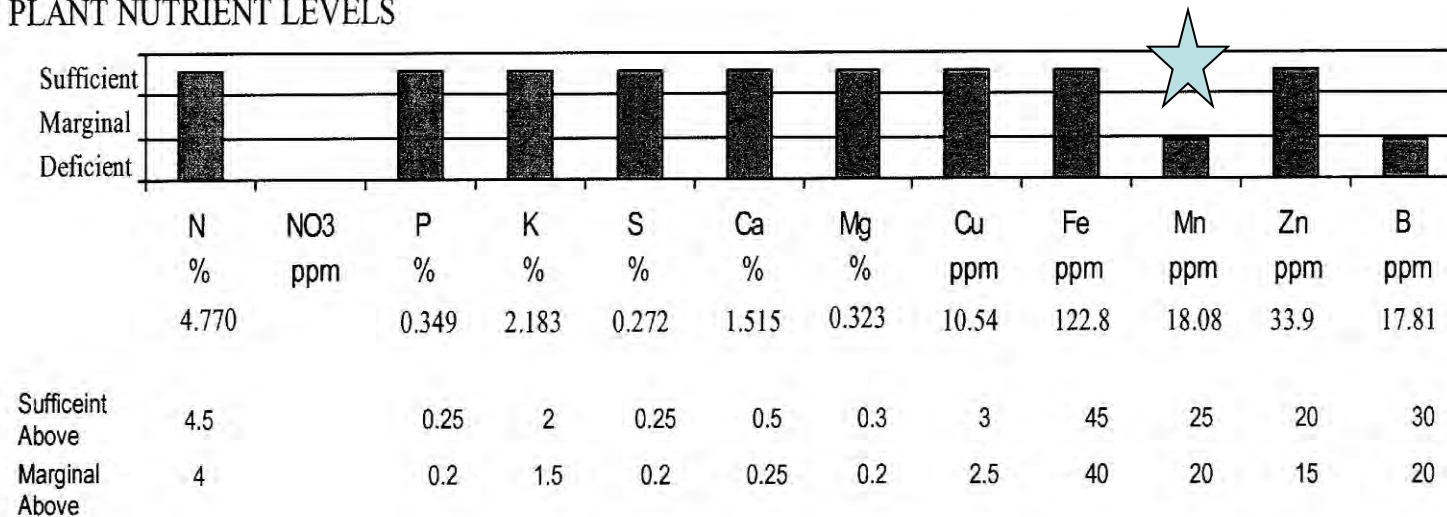
Plant Part **Whole Plant**

Growth Stage **Vegetative**

Variety

(aboveground)

PLANT NUTRIENT LEVELS

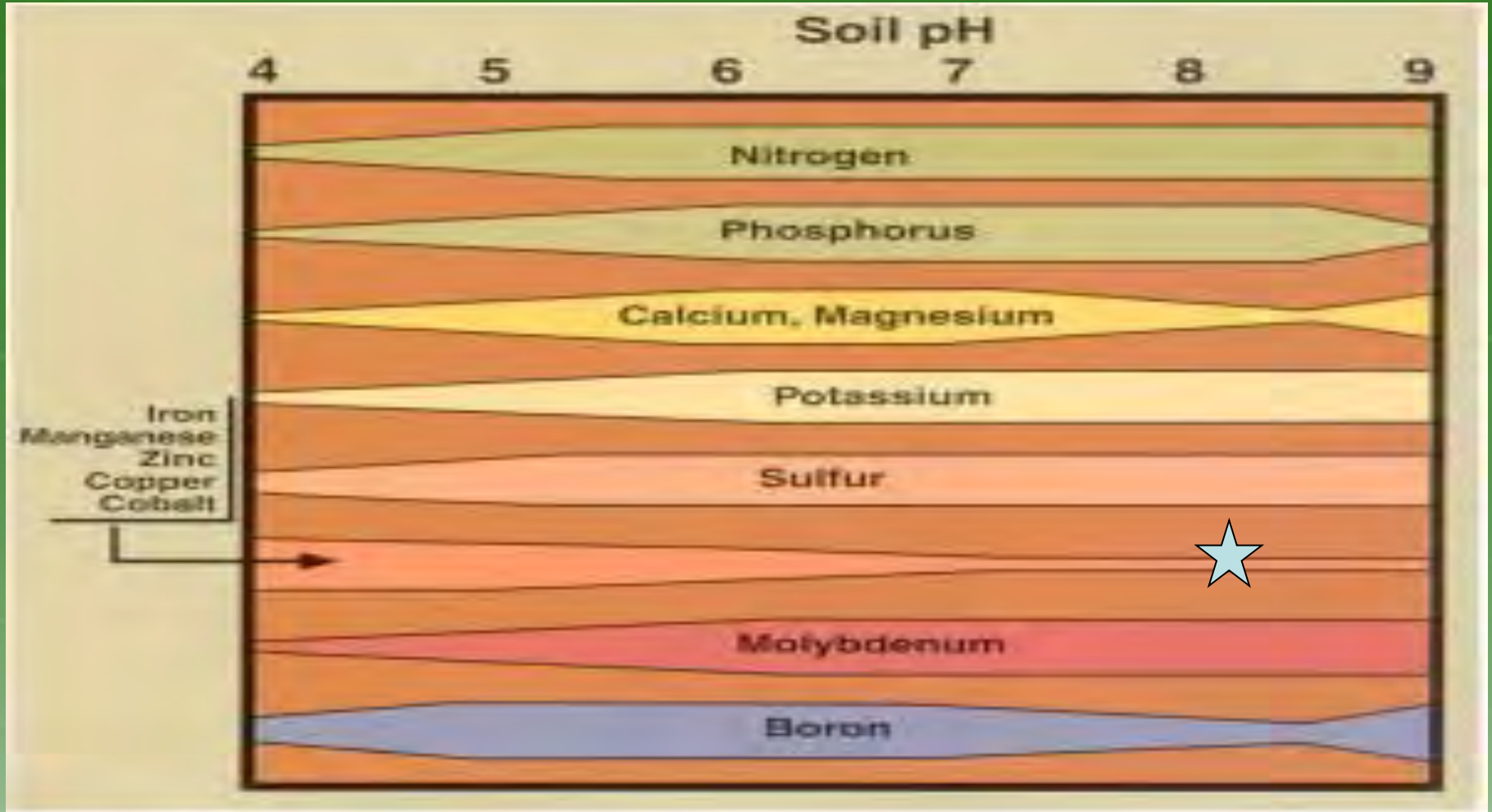


NUTRIENT RECOMMENDATION RATES (lb actual/ac)

Nutrient	N	P O ₂ 5	K O ₂	S	Ca	Mg	Cu	Fe	Mn	Zn	B
	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0 - 0	0.15 - 0.45	0 - 0	0.3 - 0.35



Soil pH and Nutrient Availability



<http://www.extension.org/pages/9875/soil-ph-and-nutrient-availability>





Manganese

- Manganese deficiency
 - root rot noted when symptoms were visible
 - damage to alfalfa plant density already done
 - contributed to stand decline in alfalfa
 - yellowing symptoms self corrected when rains stopped and soils dried out
 - one possible mechanism for decline of alfalfa as stands age



Liebig's Law of the Minimum



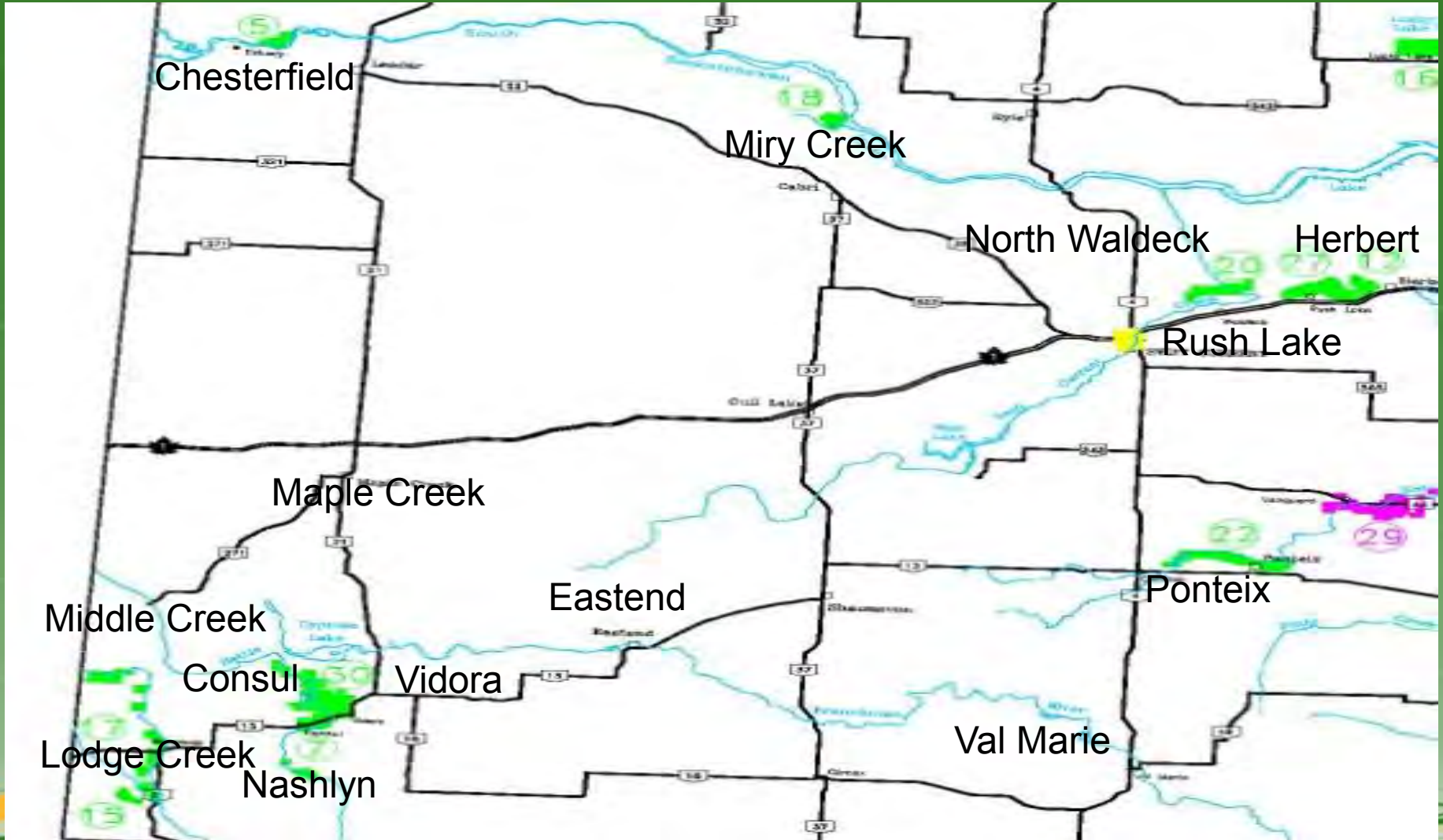
- The yield potential of a crop is like a barrel with staves (nutrients) of unequal length.
- The capacity of the barrel is limited by the length of the shortest stave and can only be increased by lengthening that stave.
- When that stave is lengthened, another stave becomes the limiting factor.

[http://www.microsoil.com/
liebigs_law_of_the_minimum.htm](http://www.microsoil.com/liebigs_law_of_the_minimum.htm)





Southwest Irrigation Districts





Soil Analysis - Plot 13 at Miry Creek Fall 2010

SAMPLE IDENTIFICATION	ORGANIC MATTER		PHOSPHORUS						NEUTRAL AMMONIUM ACETATE (EXCHANGEABLE)								pH	CATION EXCHANGE CAPACITY	PERCENT BASE SATURATION (COMPUTED)				
									POTASSIUM		MAGNESIUM		CALCIUM		SODIUM				BUFFER INDEX	C.E.C.	% K	% Mg	% Ca
			P ₁	P ₂	BICARBONATE P	K	Mg	Ca	Na	1:1	meq/100g												
280081	2.2	L	8	L	44	H	12	M	322	H	1061	VH	4476	H	183	H	8.5	32.8	2.5	27.0	68.1	2.4	

NITRATE-N (FIA)										DTPA Extraction										EXCESS LIME RATE	SOLUBLE SALTS			
Surface			Sub 1			Sub 2			Total	SULFUR S	ZINC Zn	MANGANESE Mn	IRON Fe	COPPER Cu	BORON B	mmhos/ RATE	cm							
ppm	lbs/A	depth IN	ppm	lbs/A	depth IN	ppm	lbs/A	depth IN	lbs/A	ICAP	ppm RATE	ppm RATE	ppm RATE	ppm RATE	ppm RATE									
17	31	0-6							31	12	L	1.0	L	2	VL	15	M	2.3	VH	1.9	VH	M	0.6	L

SOIL FERTILITY RECOMMENDATIONS (POUNDS PER ACRE)

SAMPLE ID	CROP		YIELD GOAL	SOIL AMENDMENT				N	P ₂ O ₅	K ₂ O	Mg	S	Zn	Mn	Fe	Cu	B
	INTENDED	PREVIOUS		LIME	LIME	GYPSUM	ELEMENTAL	NITROGEN	PHOSPHATE	POTASH	MAGNESIUM	SULFUR	ZINC	MANGANESE	IRON	COPPER	BORON
				LBS/A of CaCO ₃	TONS/A 90% ECCE			TONS/A	LBS/A								
30081	ALFALFA - ton	UNKNOWN	3				20	--	40	--	--	9	1.8	2.3	--	--	--
	WHEAT SPRING -bu	UNKNOWN	50				20	85	25	10	--	5	1.3	1.8	--	--	--



Demonstration Layout on Plot 13 at Miry Creek

Fertilizer Banded
November 6, 2010

West Control

12-15 in. H₂O =
50-75 lb S/ac/yr

100 lb P₂O₅

120 lb K₂O

100 lb P₂O₅ + 120 lb K₂O + 4 lb Zn

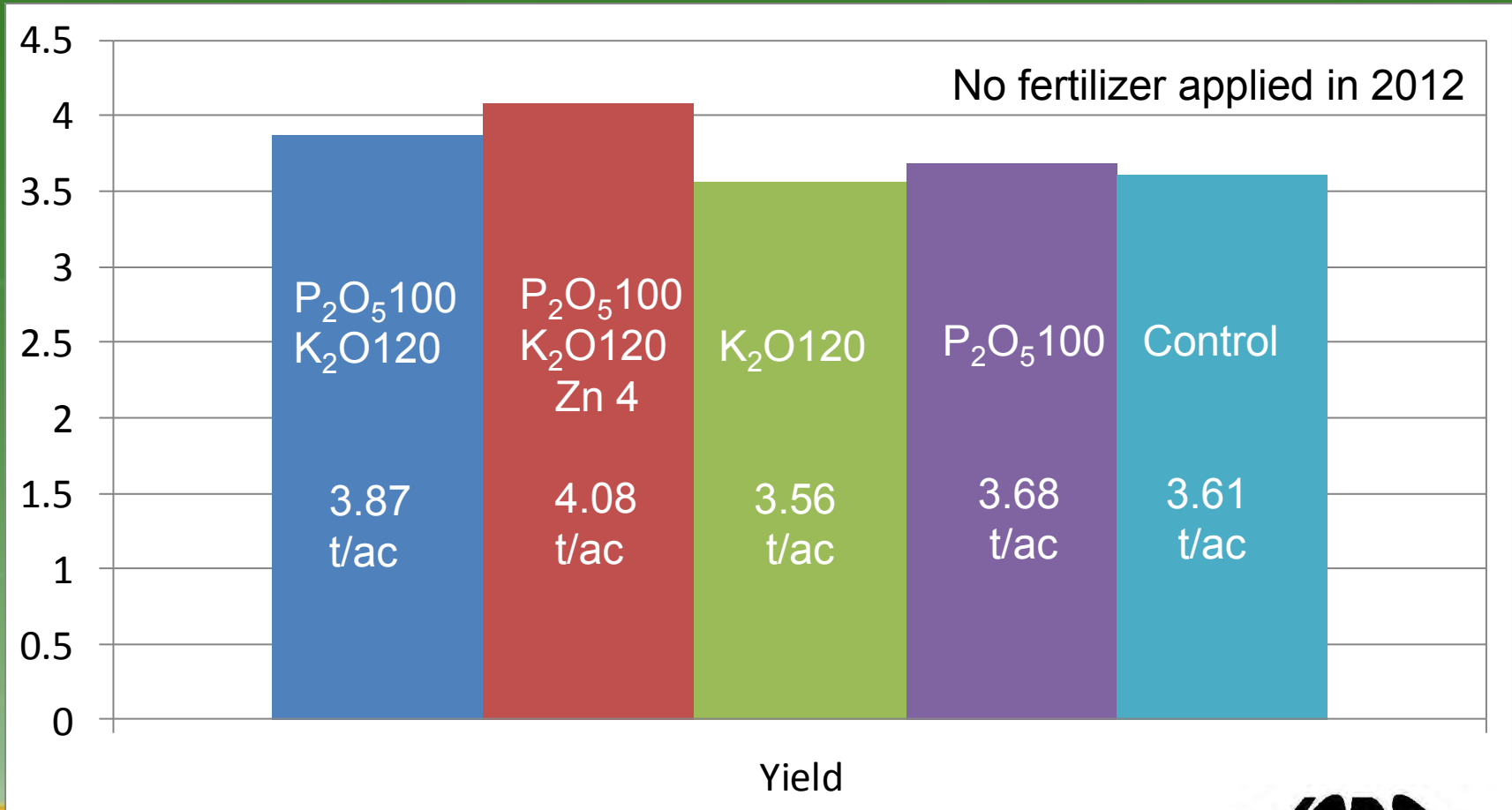
100 lb P₂O₅ + 120 lb K₂O

East Control





Miry Creek 2012 2-cut Alfalfa Yield (ton/ac)





Miry Creek 2012

Plant Tissue and Yield Results

Treatment	Cost (\$/ac)	N (%)	P (%)	K (%)	Mn (%)	Zn (%)	Yield (ton/ac)	Relative Yield
P100K120	\$130	4.25	0.37	2.4	32	20	3.87	1.07
P100K120Zn4	\$155	4.36	0.38	2.3	34	28	4.08	1.13
P100	\$70	4.26	0.35	2.2	34	21	3.68	1.02
K120	\$60	3.45	0.32	2.3	29	24	3.56	0.99
Control*	--	4.20	0.37	2.3	35	25	3.61	
Adequate		4.00	0.25	2.0	25	20		

Soil Sample suggested P, K, S, Mn, and Zn required –

Only P, K, and Zn applied – S from irrigation water

Plant Tissue suggested P, K, S, Mn were adequate for first cut





Miry Creek 2012

- Goal – demonstrate balanced fertilization of both P and K
 - Did show response to Zn on a flood irrigated land levelled field
 - Response to P but little benefit from K



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N rate for Irrigated Oats on Terminated Alfalfa Stubble

- High rates of N release under good moisture conditions
- Two varieties – Triactor and CDC Haymaker
- N rates – 0, 25, 50, 75, 100 and 125 kg/ha
- Seeding date – May 31, 2012



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N rate for Irrigated Oats on Terminated Alfalfa Stubble

Oat Variety	Grain Yield (bu/ac)	Forage Yield (t/ac)
Triactor	114.8	6.23
CDC Haymaker	120.2	6.04

N rate (kg/ha)	Grain Yield (bu/ac)	Forage Yield (t/ac)
0 N	126.7 a	5.48
25 N	120.7 ab	6.47
50 N	121.9 ab	6.03
75 N	113.6 bc	6.40
100 N	113.9 bc	6.35
125 N	108.3 c	6.08
LSD (0.05)	11.1	NS



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Sulphur

- Rain leaches S in sandy loam soil
- Roots of annuals need to reach deeper soil to access sufficient S
- Suspected for alfalfa at Consul, Miry Creek and Chesterfield based on soil test and based on plant tissue in 2011 at Chesterfield



<http://landresources.montana.edu/soilfertility/sdeficiency.html>



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P, K, B, & S Fertilization @ Consul

Treatment	Product Applied (lb/ac)	N (lb/ac)	P ₂ O ₅ (lb/ac)	K ₂ O (lb/ac)	S (lb/ac)	Yield (ton/ac)
P Broadcast	17-34-0 @ 173 lb/ac	29	75	0	0	2.37
PK Broadcast	10-25-25-0 @ 298 lb/ac	29	75	75	0	2.69
PKS Broadcast	9-23-22-4 @ 332 lb/ac	29	75	75	15	2.48
PS Broadcast	14-36-0-7 @ 207 lb/ac	29	75	0	15	2.76





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P, K, B, & S Fertilization @ Consul

Plant Tissue Analysis - Consul

Treatment	N (%)	P (%)	K (%)	S (%)	Cu (ppm)	Fe (ppm)	Mn (ppm)	Zn (ppm)	B (ppm)
P Broadcast	4.0	0.33	2.7	0.34	8	99	40	31	37
PK Broadcast	4.0	0.34	2.9	0.38	9	92	35	32	46
PKS Broadcast	4.2	0.35	3.0	0.34	9	67	31	32	42
PS Broadcast	4.2	0.32	2.9	0.36	9	68	30	32	43
Threshold	4.5	0.25	2.0	0.30	8	50	20	20	30



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Other projects

- Fungicide on irrigated crops (Rory)
 - White mold control on dry bean
 - Pasmus control on flax
 - Fusarium and tan spot control on wheat, durum and winter wheat
- Canola seeding rate trial (Garry H)
- Durum and soft wheat seeding rate trial
- Evaluation of pasture blends (Sarah)
- Forage biomass for ethanol production
- Corn varieties for silage and grazing



Conclusion

- Liebig's Law applies to forages too!!!
- Soil and plant tissue testing are important tools for managing forage production
- The obvious solution is often not the complete solution. All growth factors need to be considered to provide the best solution!!





Acknowledgement

- Crop Production Services – Outlook
- blending services
G-Mac's Ag Team – Leader and Eatonia
- fertilizer application
- Viterra – fertilizer and blending - Shaunavon
- Dept of Plant Science, U of S – oat seed
- Salford Farm Machinery Ltd.- tillage
- Nexus Ag – Cu and Zn fertilizer
- United Agri Products – Mn fertilizer
- ADOPT – Agricultural Demonstration of Practices and Technology



Our Cooperators

- Bill Coventry – Mantario
- Greg Oldhaver – Cabri
- Russ Swihart – Consul
- Scott Sanderson – Consul
- Larry Verpy – Eastend
- Andy Perrault – Ponteix
- Pat Hayes – Val Marie

