4R Nutrient Stewardship and Sustainable Soil Management

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Today's Discussion

- What is 4R Nutrient Stewardship?
- Why would I care about 4R Stewardship?
- Discuss nutrient variability and management.
- Discuss the role variable rate fertilization can play in 4R Stewardship.

What is 4R Nutrient Stewardship?

4Rs OF NUTRIENT STEWARDSHIP

Economically, Environmentally & Socially Sustainable Crop Nutrition

The 4Rs promote best management practices (BMPs) to achieve cropping system goals while minimizing field nutrient loss and maximizing crop uptake.

4R Principles of Nutrient Stewardship

RIGHT SOURCE

Matches fertilizer type to crop needs.

RIGHT RATE

Matches amount of fertilizer to crop needs.

RIGHT TIME

Makes nutrients available when crops need them.

RIGHT PLACE

Keeps nutrients where crops can use them.

Why Should I be Concerned about Improving Fertilizer Use Efficiency?

- Improving fertilizer use efficiency has two main benefits. Economic and environmental.
- Improving the ROI on fertilizer only makes sense and makes farmers better managers.
- Improved management of N fertilizers reduces greenhouse gas emissions is good for the environment and good for our industry.
- What does greenhouse gas reduction have to do with fertilizer applications?

Major Agricultural Greenhouse Gases

Greenhouse Gas	Global Warming Potential (CO_2 Equivalents)
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310

One tonne of N_2O X 310(GWP) = 310 tonnes of CO_2.
How we manage N fertilizer can reduce these emissions.

Source: IPPC, 1996

SUSTAINABILITY GOALS

ENVIRONMENTAL

Sustain or improve soil quality

Maintain nutrient levels within natural ecosystems

Preserve wildlife habitat

SOCIAL

Produce nutritious, abundant and affordable food

Help meet global food needs

Provide ongoing employment opportunities in agriculture

ECONOMIC

Produce revenue to sustain farm operations

Preserve quality of life

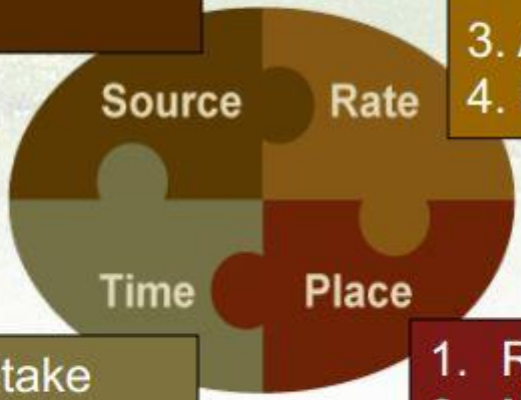
Make the most of dollars spent on fertilizer

4 nutrient stewardship

The basic scientific principles of managing crop nutrients are universal

1. Supply in plant available forms
2. Suit soil properties
3. Recognize synergisms among elements
4. Blend compatibility

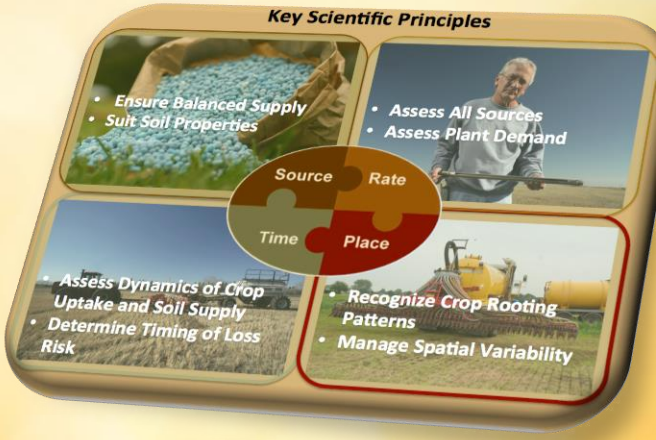
1. Appropriately assess soil nutrient supply
2. Assess all available indigenous nutrient sources
3. Assess plant demand
4. Predict fertilizer use efficiency



1. Assess timing of crop uptake
2. Assess dynamics of soil nutrient supply
3. Recognize timing of weather factors
4. Evaluate logistics of operations

1. Recognize root-soil dynamics
2. Manage spatial variability
3. Fit needs of tillage system
4. Limit potential off-field transport

The Seven Essential Components That Make 4R



4R Nutrient Stewardship forms the Basis of Fertilizer Recommendations

FERTILIZER CANADA
FERTILISANTS CANADA
eLearning

Certificate of Completion

This document certifies that

J.C. (Jack) Payne

has successfully completed the

4R Nutrient Stewardship Training - Part 1
4R Nutrient Stewardship Training - Part 2
4R Nutrient Stewardship Training - Part 3

FERTILIZER CANADA
FERTILISANTS CANADA

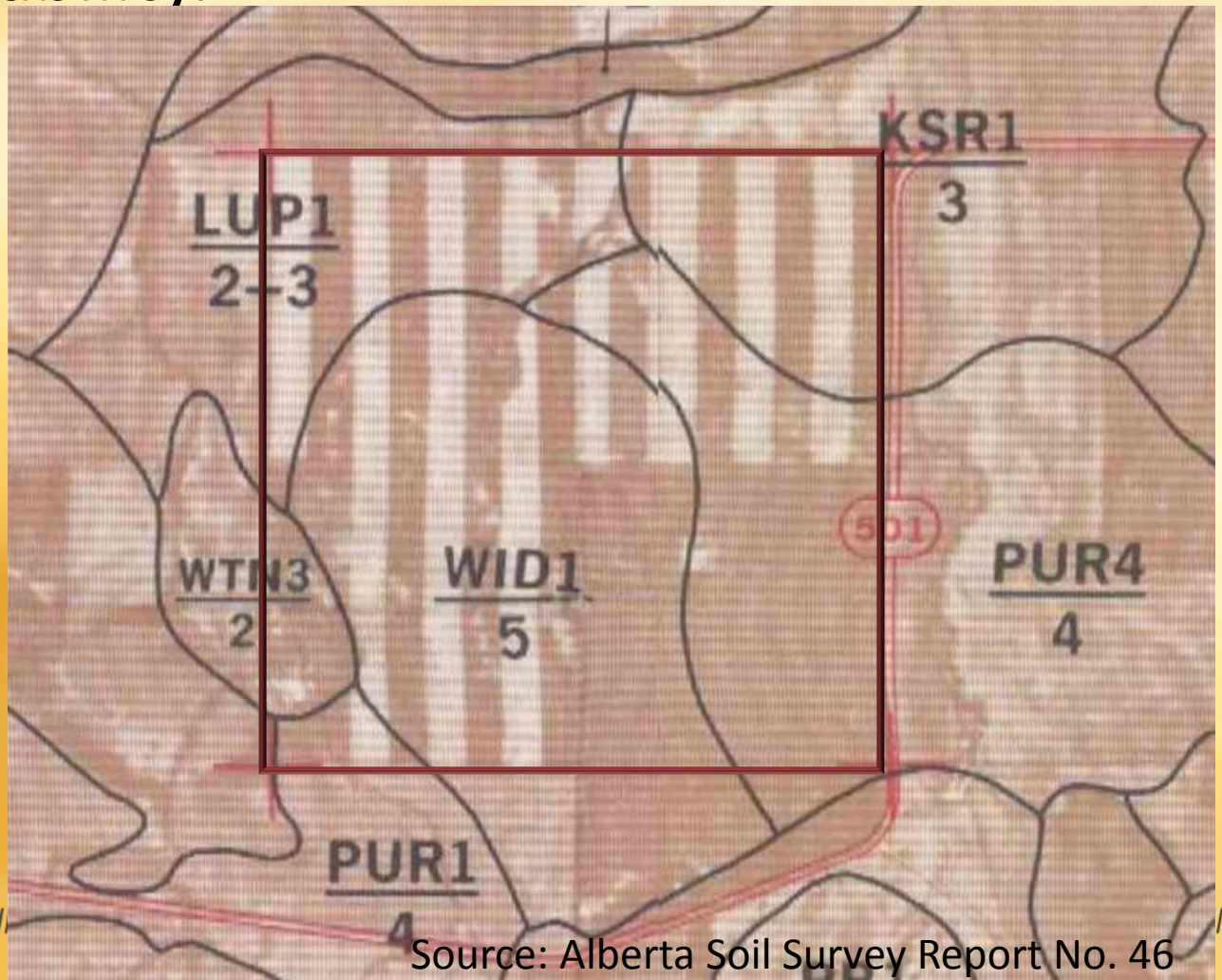
Fertilizer Canada

March 31, 2016 — Date
March 31, 2021 — Expiry Date

Farmers Edge #4305 - CCA #26764

Understanding Soil Variability

- Some parcels of land have inherent soil variability.



Source: Alberta Soil Survey Report No. 46

Zone Sampling – Field is divided into zones based on soil characteristics, landscape position, and/or yield potential and a composite sample taken from each zone.

Fertilizer recommendations are then developed for each zone and applied using variable rate technology.

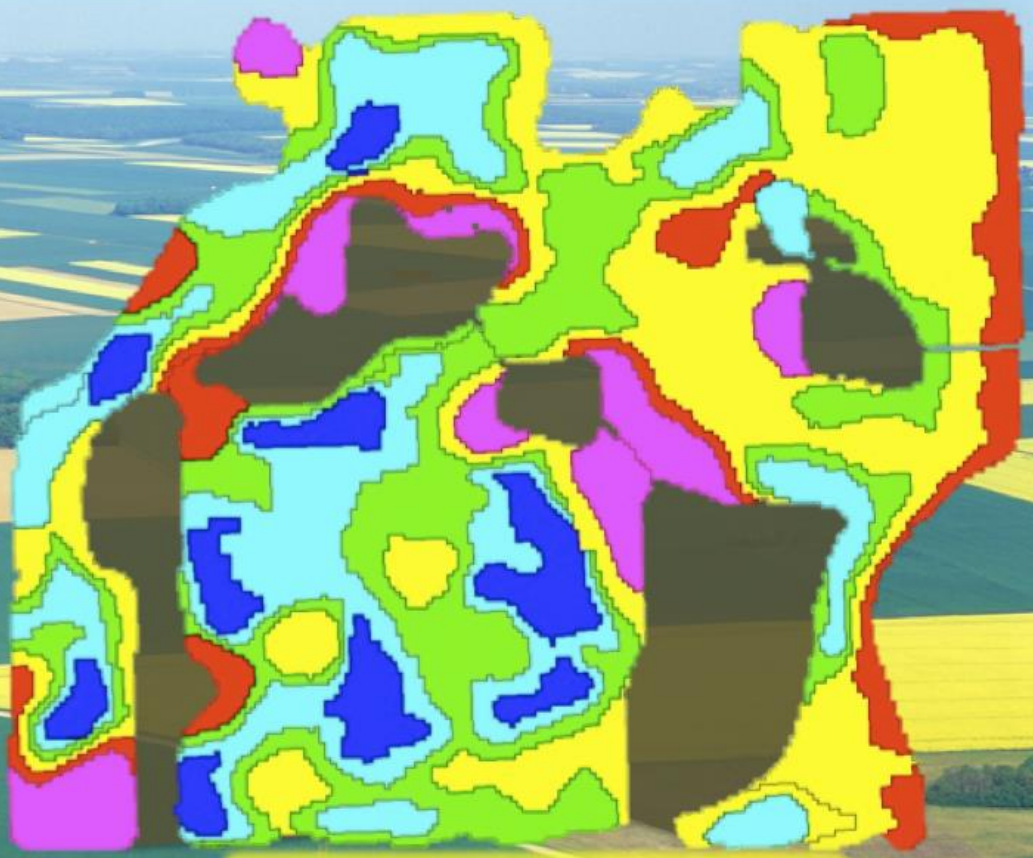


Image courtesy of Farmer's Edge Agronomy

4R nutrient stewardship

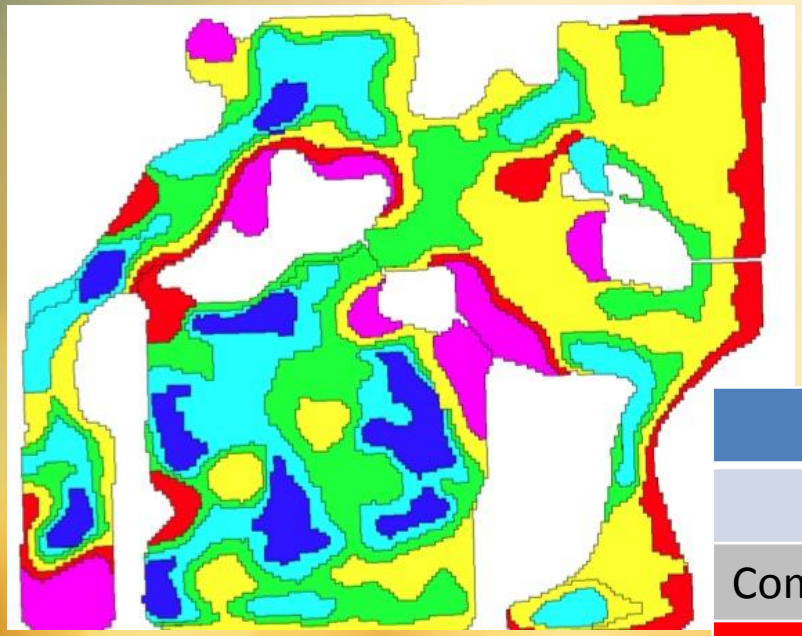
Precision Zone Soil Sampling

One Size Fits All

Soil Test P = 11 ppm or 22 lbs/ac

P Recommendation = 40 lbs P_2O_5/ac

Zoned Fertilizer Recommendations



The zone recommendation is a better fit than the one size fits all approach.

	STP	Fertilizer
	ppm	P_2O_5 lbs/ac
Composite	11	40
Zone 2 (low target yield - saline)	22	10
Zone 4 (moderate target yield)	5	45
Zone 6 (high target yield)	10	50

Field Variability

Report generated: 2016-10-19 14:07, season: 2016, scenario: Wheat 2016

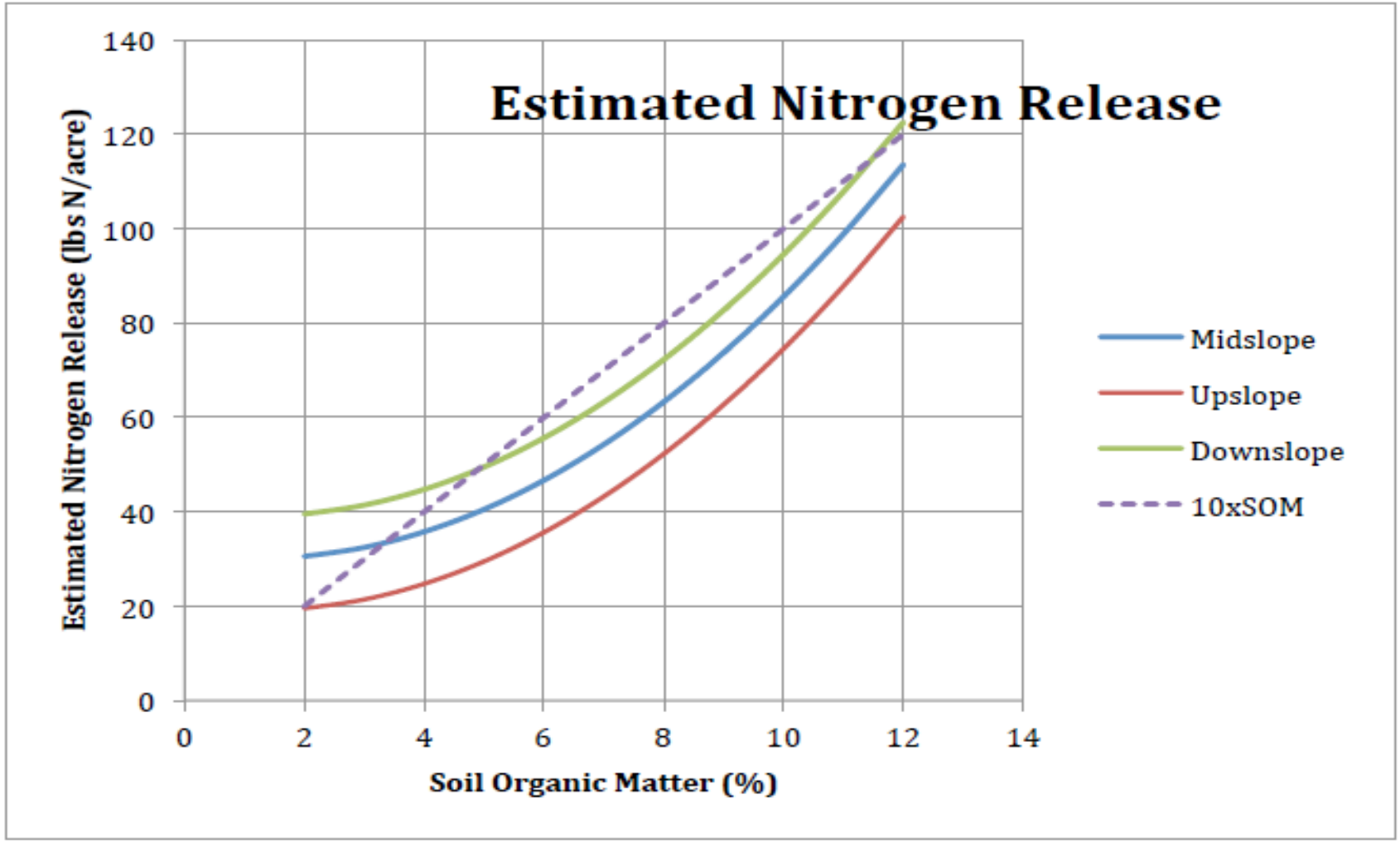
Sample Description						Macronutrients						
Zone	Lab ID	Lab ID	Zone	Sample	Sample	N03-N			P - Other	K	S04-S	
	Surface	Sub Surface	Acres	Depth	Depth	lb/Ac Surf	lb/Ac Sub	Total lb/Ac	ppm	ppm	lb/Ac Surface	lb/Ac Sub
1	151029_107	151029_107	14	0-6	6-24	8	7	15	4	110	23	240
2	151029_107	151029_107	23	0-6	6-24	33	22	55	10	110	22	140
3	151029_107	151029_107	27	0-6	6-24	41	22	64	11	170	93	520
4	151029_107	151029_107	41	0-6	6-24	47	32	79	11	180	45	330
5	151029_107	151029_107	35	0-6	6-24	26	24	50	16	170	44	160
6	151029_107	151029_107	13	0-6	6-24	63	24	87	17	160	73	250

Macronutrients				Cation Exchange and Base Saturation						Texture
Zone	Ca	Mg	Na	CEC	Base Sat.	Ca	Na	K	Mg	Texture
	ppm	ppm	ppm	meq/100g	%	%	%	%	%	
1	2100	510	16	15.1						
2	1400	400	18	14.4						
3	1400	430	21	15.3						
4	2000	390	15	16.6						
5	1800	400	19	12.6						
6	2100	490	20	14.8						

Field Variability

Macronutrients								Soil Quality				
Zone	Cu	Fe	Mn	Zn	B	Cl		pH(1:2)		EC(Sat. Paste Equiv.)		OM
	ppm	ppm	ppm	ppm	ppm	lb/Ac Surface	lb/Ac Sub	Surface	Sub Surface	dS/m Surf	dS/m Sub	%
1	0.8	68.3	3.2	0.7	0.3	11	21	7.1	8.0	0.19	0.29	3.5
2	0.7	114.8	7.1	1.6	0.3	18	36	6.0	7.9	0.14	0.28	5.4
3	0.7	115.5	8.2	1.4	0.4	24	41	5.9	7.4	0.28	0.45	4.5
4	0.7	98.5	5.6	2.1	0.5	19	28	6.3	7.7	0.26	0.34	5.0
5	0.6	103.5	3.7	2.3	0.5	18	15	7.5	8.3	0.17	0.26	5.4
6	0.9	130.3	5.1	1.6	0.5	22	13	7.4	7.9	0.25	0.29	4.9

Slope Position Affects N Mineralization



General Mineralization Rates vary by Soil Zone and Soil Moisture

Soil Zone	Average organic matter (%)	Average Moisture Conditions (% of Normal)		
		25%	50%	75%
		lb N/acre (lbs N /% O.M.)		
Brown	2	15 (7.5)	27 (13.5)	32 (16)
Dark Brown	3.5	24 (6.9)	44 (12.6)	53 (15.1)
Thin Black	4	28 (7.0)	50 (12.5)	60 (15.0)
Thick Black	5.5	34 (6.2)	62 (11.3)	74 (13.5)
Gray Black	3.5	24 (6.9)	44 (12.6)	53 (15.1)
Gray	2.5	20 (8.0)	35 (14.0)	42 (16.8)
Average lbs N / % O.M.		(7.1)	(12.7)	(15.3)

Source: VST Handbook

Field Variability

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3.5% OM X 15.1 = 52.8 lbs of mineralized N in wet conditions
5.4% OM X 15.1 = 81.5 lbs of mineralized N in wet conditions

3.5% OM X 7 = 24.5 lbs of mineralized N is the standard most agronomists use to calculate mineralized N.
Using standard values in a wet year underestimates total N that is mineralized.

Lodged Crops

Summary

- Good nutrient management starts with a soil test.
- Fertilize based on the 4R's, right product, the right rate, the right time, right place.
- If you have the capability consider using variable rate fertilizer application.
- 4R nutrient stewardship is good for the grower's pocket book, good for the environment and good for society (consumer).

FarmersEdge

[THANK YOU]

For Being on the Edge