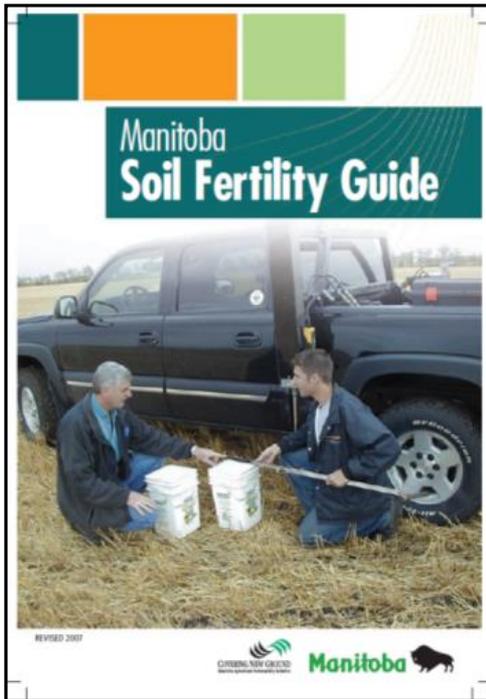


2020 View of Fertilizer Guidelines for Manitoba



**John Heard
Agdays 2020**

Manitoba 

Soil Fertility Guidelines

- Crafted by Manitoba Soil Fertility Advisory Committee
- Research, extension and industry scientists and agronomists meet annually to discuss ongoing, completed research
- What is ready for provincial guidelines



1. Table 1. Report in lb/bu. Update with MASC 3 yr yields, Remain with CFI 1998 uptake and removal values until validation of IPNI 2014 nutrient concentrations.
- 2.
3. NITROGEN
4. Table 2. Residual soil N levels – update to 2018 and include soybeans.
5. Table 5. Replace N contributions from green manure with Manitoba values from Organic Crop Production Handbook.
6. Nitrogen Fertilizer Efficiency. Insert Enhanced Efficiency Fertilizers.
7. Nitrogen placement: Add side dressing, remove nested application.
8. **Time of Nitrogen Fertilizer application. Insert Nitrogen Fertilizer Use Practices by Manitoba Farmers – Stratus survey.**
9. Seed placed N fertilizer. Remove Agrotain, add ESN
- 10.
11. PHOSPHORUS
12. **Explain concept of Short-term Sufficiency vs Balance vs Long-term Sustainability concepts to managing phosphorus rates.**
13. **Insert Phosphorus Fertilizer Use Practices by Manitoba Farmers – Stratus survey.**
14. Remove Jumpstart, Bioboost – move to Biofertilizers
- 15.
16. MICRONUTRIENTS
17. Table 13. Update with new yield levels.
18. Table 14. Response of crops to micronutrient fertilizers. Update with soybeans, dry beans.
19. Iron Deficiency chlorosis in soybean and flax. Update.
20. **Include a section on BIOFERTILIZERS and BIOSTIMULANTS. Examples are JumpStart, mycorrhizal inoculants, humic acid, etc.**
21. **The FERTILIZERS ACT. Edited for current regulations.. Include a section on how to evaluate new products and practices using on-farm-testing. Evaluating fertilizer products or fertilization practices with on-farm-tests**
22. Nutrient Regulations in Manitoba relating to Fertilizer. Winter spreading ban. Residual N and P limits.
23. Calculating Fertilizer Rates from Nutrient Recommendations. Remove.
24. Fall vs Spring Fertilizer Prices. Remove.
25. Fertilizer application Costs. Remove.
26. Common fertilizers and their characteristics. Add struvite. Remove blends (urea & MAP, MAP & AS).
27. Table 18. Selecting fertilizers for required amounts of nutrients. Remove.
28. Soil sampling patterns. Update zone sampling.
29. Remove ALS labs
30. Manure. No change. For information on manure management refer to the:
31. Effects of Manure and Fertilizer on Soil Fertility and Soil Quality. 2013⁵⁰
32. Properties of Manure. 2015⁵¹
33. Nitrogen fixation. Move up to nitrogen section. More on soybean inoculation.
34. Table 20. Effect of salinity on crop growth. Provide scale for 1:1 soil:water as well as saturated paste.
35. Nutrient Management Plans? Agri-maps address
36. Appendix Tables 1-16 for Nitrogen.
 1. **Update Spring wheat – to N Calculator values and 2 lb N/bu for new varieties.**
 2. Remove CPS, feed wheat
 3. Remove feed barley
 4. **Update barley (malt) – to N Rate calculator values**
 5. **Update canola – to N Rate calculator values**
 6. **Update corn – to 1.2 lb N/bu for L_M yield and 1 lb N/bu for H yield potential**
 7. **Update rye – 1.9 lb N/bu for OP rye, 1.6 lb N/bu for hybrid rye**
- 37.
38. **Appendix Table 17. Phosphorus recommendations. Label as the sufficiency approach. Include a Long-term Sustainability option and steps to develop.**
39. Appendix Table 18. Potassium. No changes
40. Appendix Table 19. Sulphur. No changes
41. Appendix Table 20. Micronutrients. No changes.
42. Appendix Table 21. Common methods of micronutrient application. Powdered or liquid micronutrients are marketed for application at low rates onto granular fertilizer. Published research is lacking for such practices, so on-farm-trials are a good way to compare or confirm product performances.
43. Developing Fertilizer Recommendations Without a Soil Test and Developing a Fertilizer Rate. Revise.
44. Target yields based on available moisture. Update if data.

Soil fertility guideline update

- 4R Framework
 1. Farmer 4R practices for N&P
 2. N rate guidelines for wheat, barley, canola, corn and rye.
 3. P fertilization options
 4. Biostimulants, biofertilizers and novel product testing

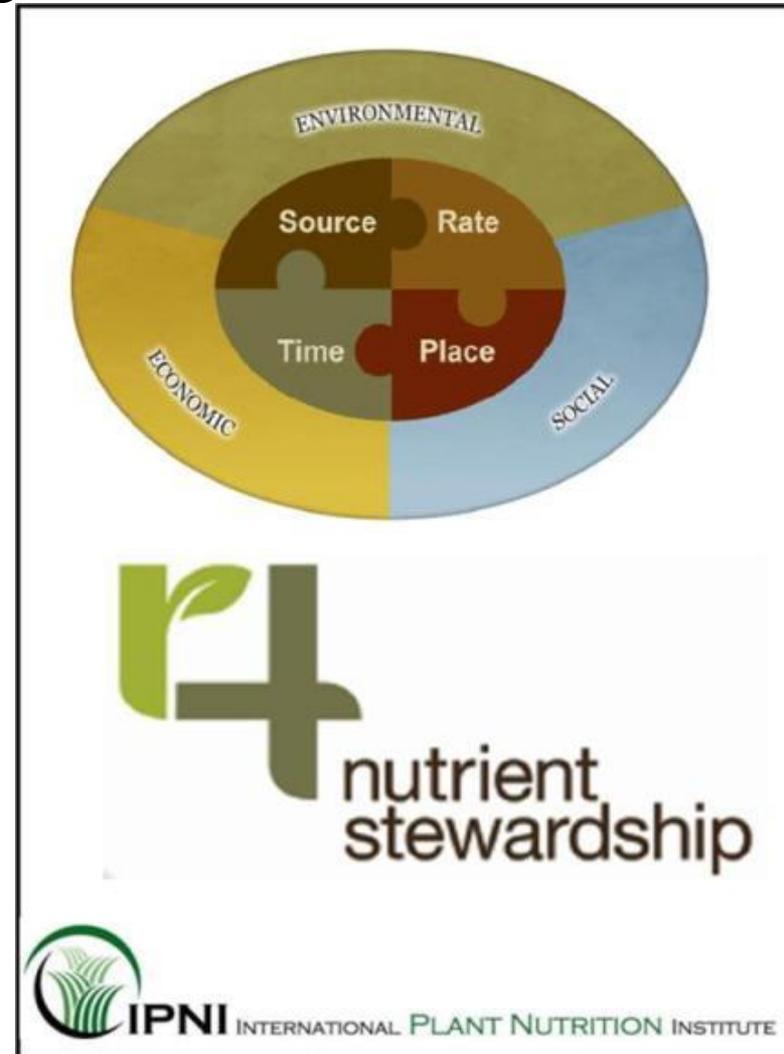


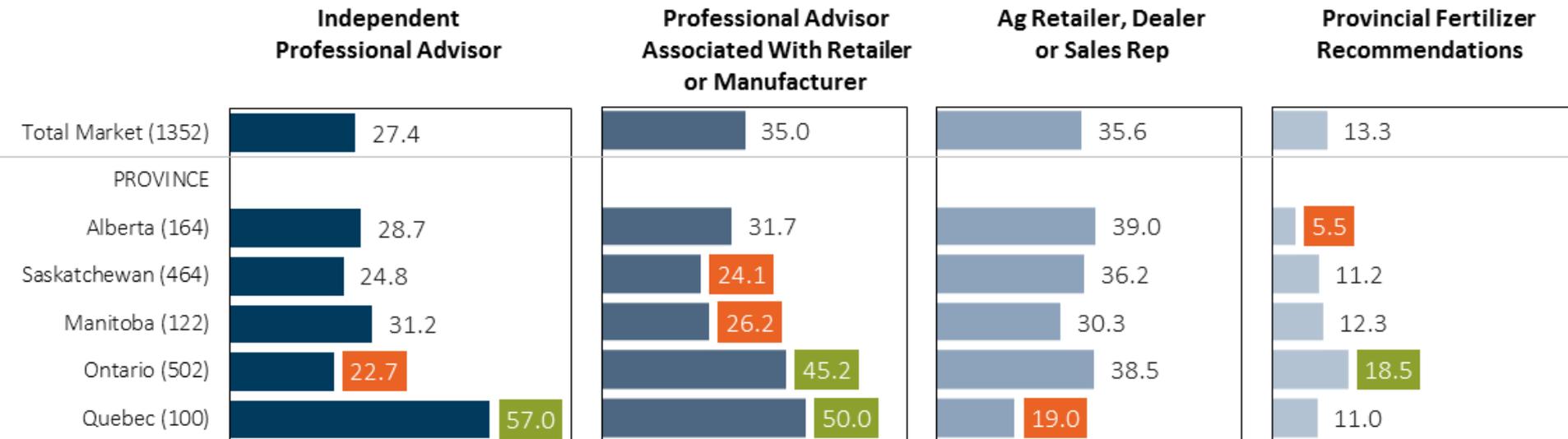
Table 1. Nitrogen fertilizer placement and timing in Manitoba for spring wheat, canola, soybeans and corn (based on % of acres or volume applied).STRATUS

Practice	Wheat	Canola	Soybeans	Grain corn
	% of acres or volume applied			
PLACEMENT				
Broadcast , no incorporation	0	2	0	11
Broadcast and incorporated	4	13	0	35
Preplant banded	52	40	0	39
Sidebanded	12	12	2	13
Mid row banded	17	19	1	3
Seed placed	13	11	1	2
In crop applied	2	2	1	22
TIMING				
Fall	45	34	1	32
Spring, preplant	11	13	0	48
At seeding	43	51	4	23
Post seeding, in crop	2	2	1	22

Table 2. Phosphorus fertilizer placement and timing in Manitoba for spring wheat, canola, soybeans and corn (based on % of acres or volume applied).

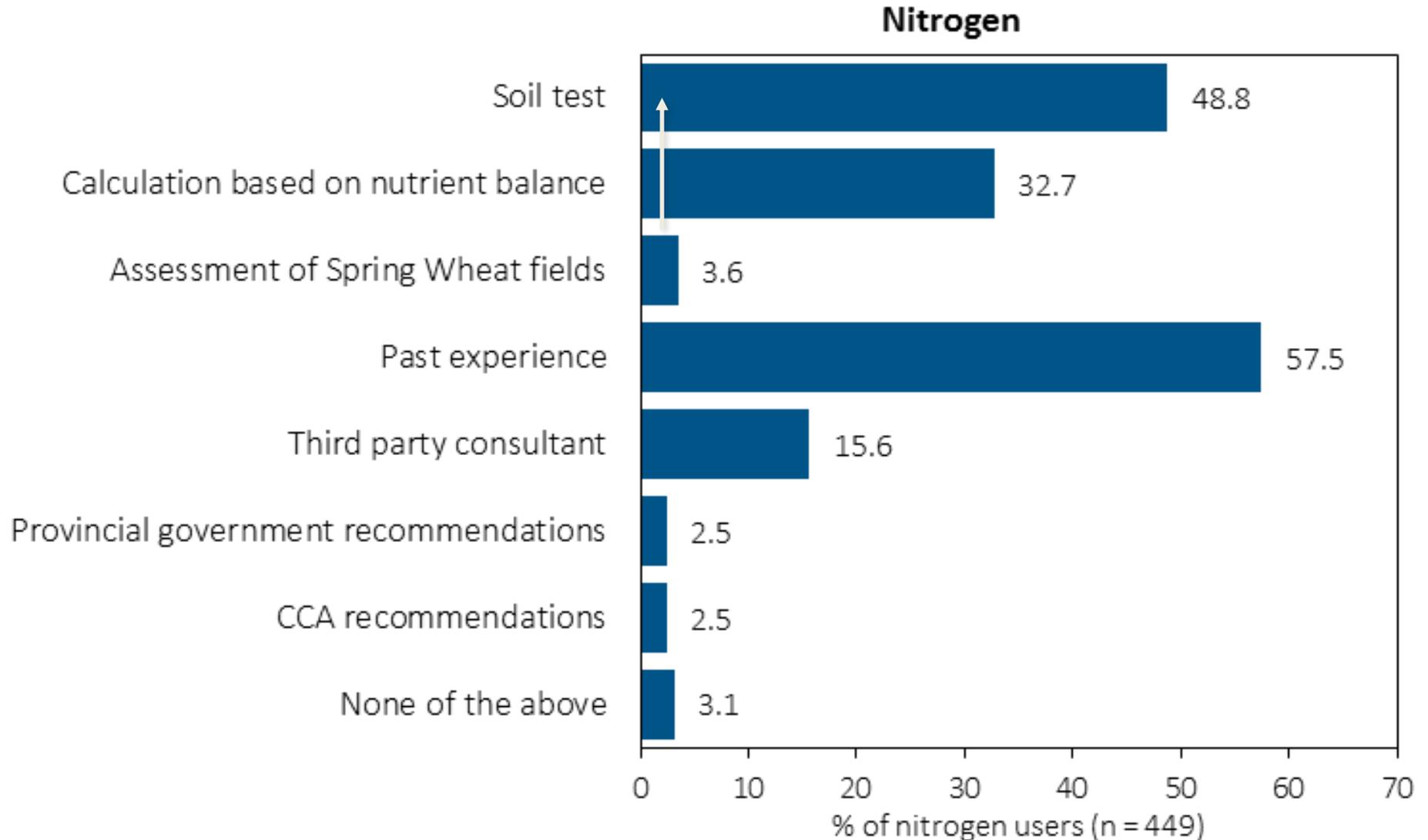
Practice	Wheat	Canola	Soybean s	Grain corn
	% of acres or volume applied			
PLACEMENT				
Broadcast , no incorporation	0	1	2	5
Broadcast and incorporated	3	9	14	35
Preplant banded	7	3	6	21
Sidebanded	23	13	13	19
Mid row banded	14	11	6	3
Seed placed	54	62	11	32
In crop applied	1	0	1	0
TIMING				
Fall	6	2	17	23
Spring preplant	3	5	6	34
At seeding	91	92	34	55
Post seeding, in crop	0	0	1	0

Sources of Fertilizer Advice

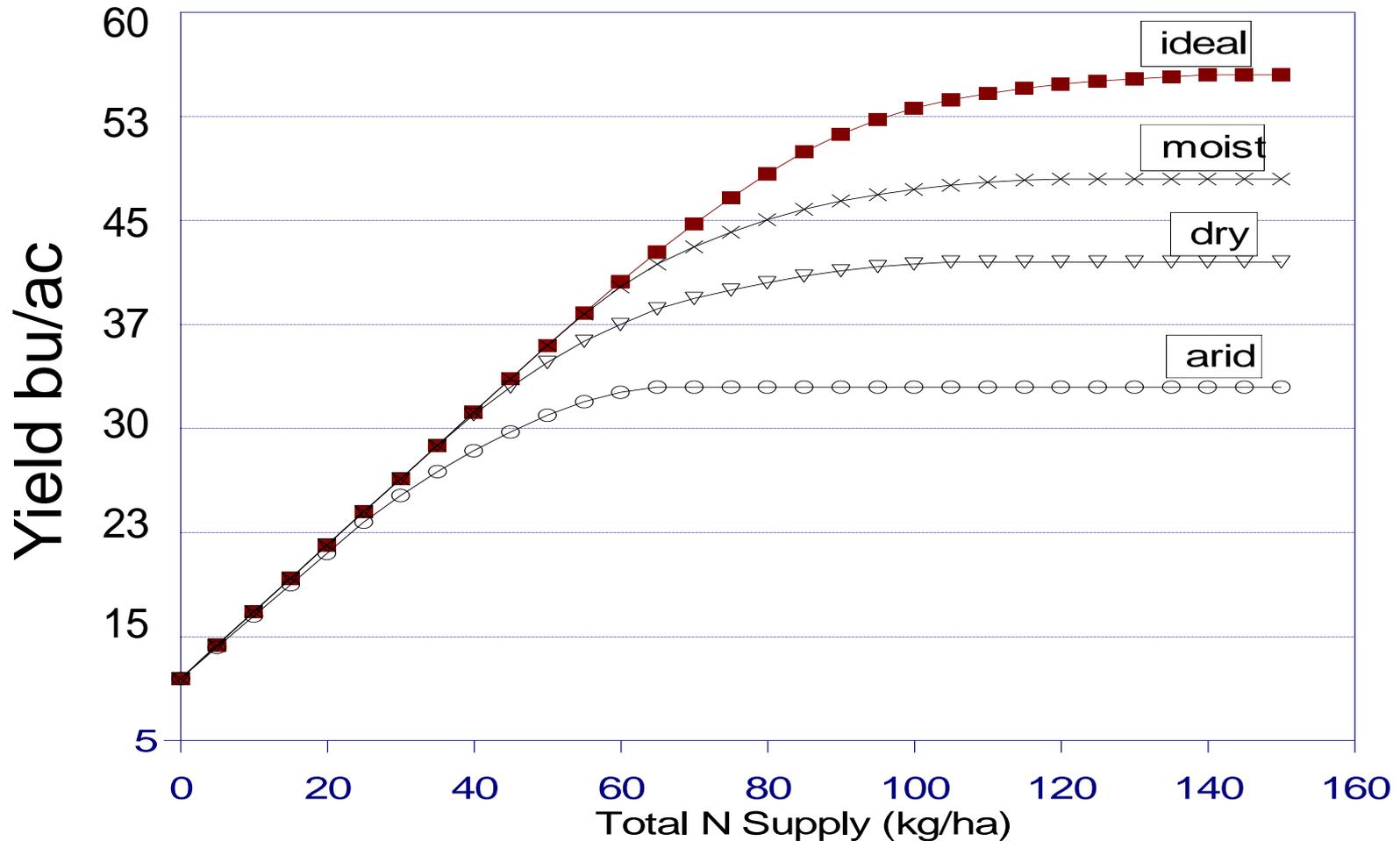


Respondents were asked: “In 2016, did you use any of the following for your decisions about fertilizer and nutrient management? (Please check all that apply.)”

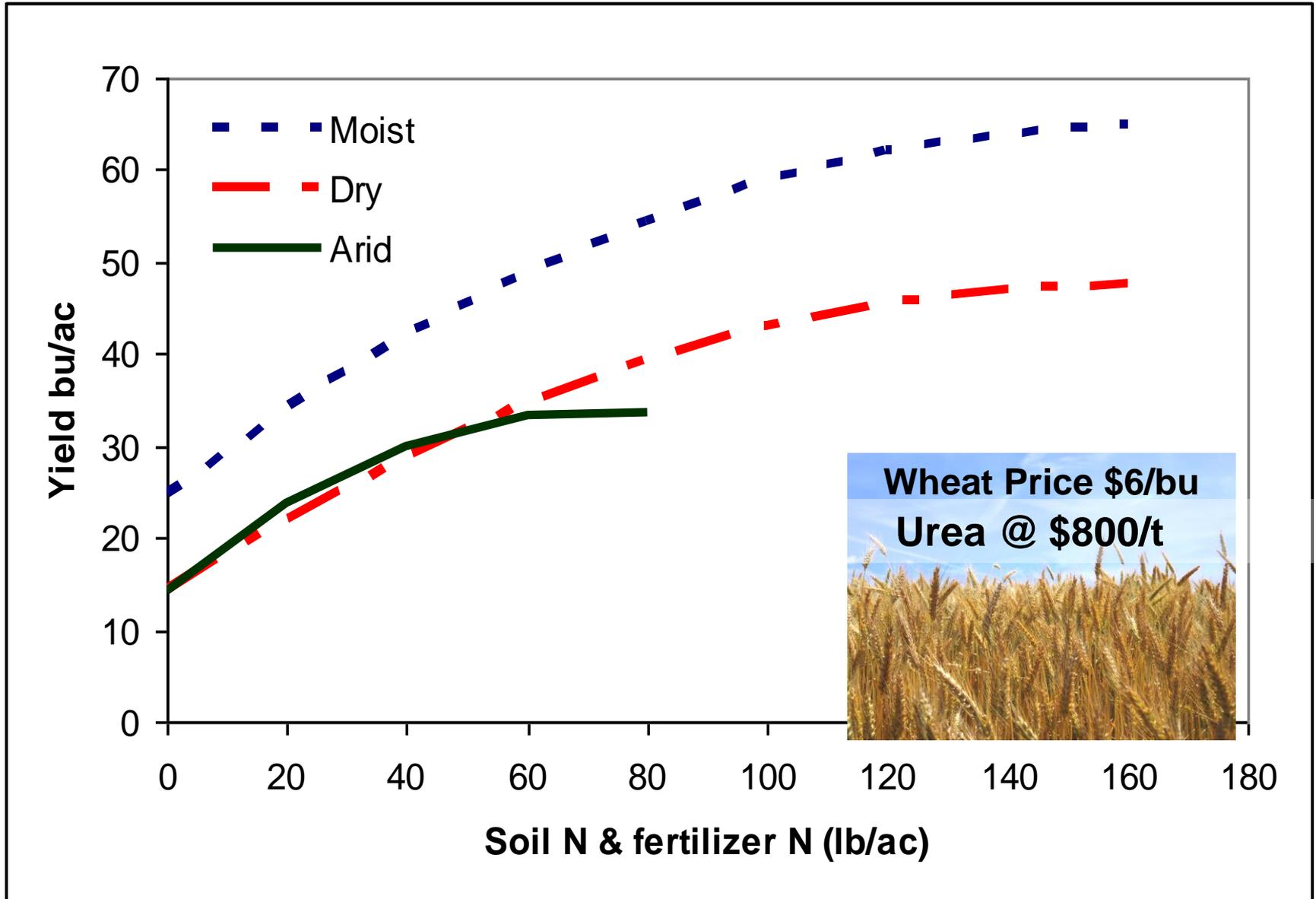
Approaches Used to Decide Fertilizer Rate in Spring Wheat



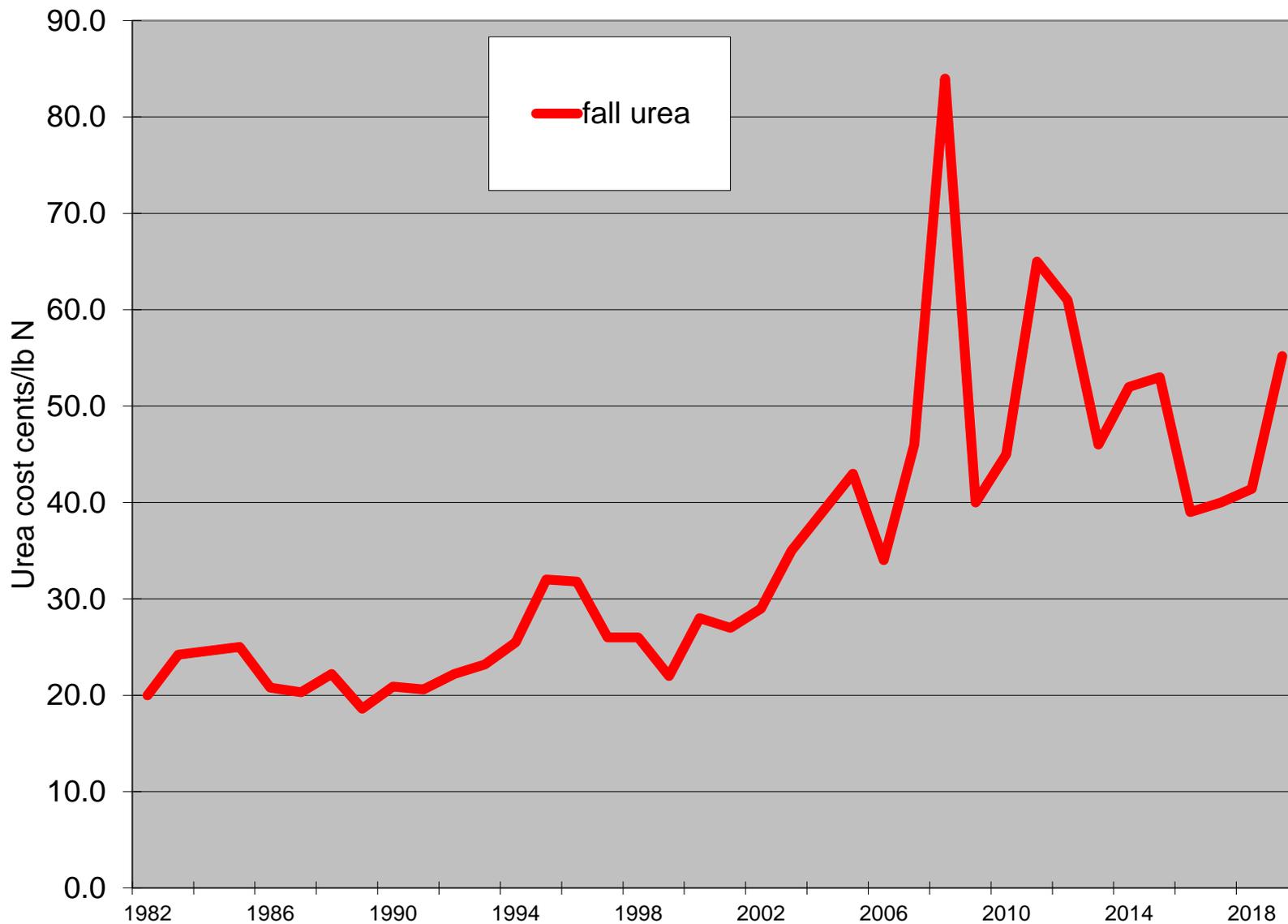
EFFECT OF N ON CWRS WHEAT YIELD (Man. Soil Fert. Advis. Committee)



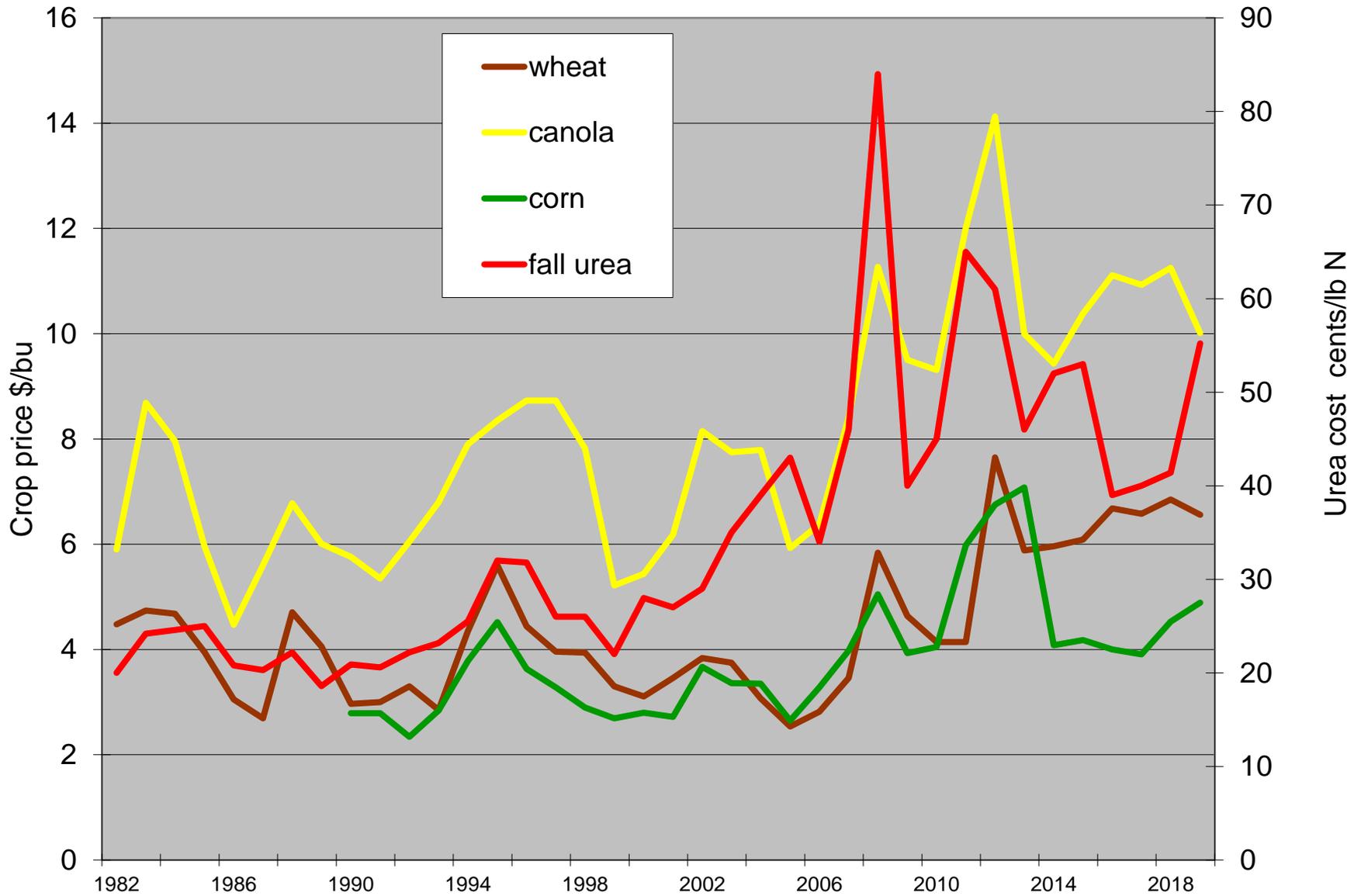
Newer N Recommendations for Spring Wheat



Relationship between MB crop and fertilizer prices



Relationship between MB crop and fertilizer prices



Nitrogen Rate of Return Calculator

Wheat, Barley, Canola & Hybrid Canola

Manitoba

Fertilizer N data	
Fertilizer Type	UREA
Cost/tonne	\$500
%N	46
Cost/Unit of N	\$0.49
Fertilizer N increment	10
Crop price increment, \$	\$0.50
Soil test N (0-24") lb N/acre	30
Fertilizer price increment, \$/tonne	\$50
Yellow Cells Can be Modified	

Crop and Economic data	Current N Rate (lb N/acre):		
	Moist	Dry	Arid
CWRS Wheat	120	90	70
Barley	100	50	40
Canola			
Canola (hybrid)	140		
Expected prices (\$/bushel):			
CWRS Wheat	\$6.50		
Barley	\$4.00		
Canola			
Canola (hybrid)	\$11.00		

Nitrogen \$ Rate of Return Calculator

Manitoba (Moist)

[Go to Marginal Revenue Chart](#)

[Go to Fertilizer Price as variable](#)

[Return to Data Entry](#)

			Expected CWRs Wheat Price						
			Go to Total Net Return Below						
			\$5.00	\$5.50	\$6.00	\$6.50	\$7.00	\$7.50	\$8.00
N Rate (lb./acre)	Average yield (bu./ac.)	Yield Increase from 0 lb. N* (bu./ac.)	Net Return (\$/ac.)**						
			CWRs Wheat:N Price Ratio						
			10.1	11.1	12.1	13.2	14.2	15.2	16.2
80	60.5	22.4	\$72.6	\$83.8	\$95.0	\$106.2	\$117.4	\$128.6	\$139.8
90	62.0	23.9	\$74.9	\$86.8	\$98.7	\$110.7	\$122.6	\$134.5	\$146.5
100	63.1	25.0	\$75.7	\$88.2	\$100.7	\$113.2	\$125.7	\$138.2	\$150.8
110	64.0	25.9	\$75.0	\$87.9	\$100.9	\$113.8	\$126.8	\$139.7	\$152.6
120	64.5	26.4	\$72.8	\$86.0	\$99.3	\$112.5	\$125.7	\$138.9	\$152.1
130	64.8	26.7	\$69.2	\$82.5	\$95.8	\$109.2	\$122.5	\$135.8	\$149.2
140	64.7	26.6	\$64.0	\$77.3	\$90.6	\$103.9	\$117.2	\$130.5	\$143.9
150	64.4	26.3	\$57.3	\$70.4	\$83.6	\$96.7	\$109.8	\$123.0	\$136.1
160	63.7	25.6	\$49.1	\$61.9	\$74.7	\$87.6	\$100.4	\$113.2	\$126.0

*Yield responses are averages from 25-site years

Current N rate from your soil test report or common practice

**Net Return = (wheat price x yield increase) - (N price x N rate)

Net return in blue represents maximum ± \$0.50 for the CWRs Wheat:N Price Ratio range in this table and in Orange within \$1.00 of maximum

Optimum N Rate for High Yielding Spring Wheat in Manitoba (Mangin & Flaten 2018)

Site-year	Spring NO ₃ -N (0-60 cm)	Economic Optimum N Rate*	Yield at Optimum N Rate	Nitrogen Supply per bushel
	lbs. N/ac	lbs. N/ac	bu/ac	lbs. N/bu
Carman 2016	47	140	62	3.0
Brunkild 2016	40	140	75	2.4
Carman 2017	43	140	96	1.9
Brunkild 2017	43	140	110	1.7
Melita 2016	43	80	60	2.1
Carberry 2016	89	50	95	1.5
Melita 2017	11	140	74	2.0
Grosse Isle	65	110	75	2.3

Hail Damaged

Optimum soil test N + Fertilizer N per bushel = 2 lb N/bu

<http://www.mbwheatandbarley.ca/wp-content/uploads/2018/05/Mangin-Flaten-N-mgmt-for-HY-wheat-project-revised-technical-report-2018-03-31.pdf>

*Wheat prices from Jan 5, 2018, Nitrogen prices based on 5-years AVG urea price (\$0.43/lbs N)

Appendix Table 1. Nitrogen recommendations for hard red spring wheat (based on spring broadcast application)¹⁴.



Nitrogen Recommendation (lb/ac)										
SOIL MOISTURE CATEGORY		DRY			MOIST			IDEAL		
TARGET YIELD (bu/ac)		30	35	40	35	40	45	40	45	50
Fall Soil NO ₃ -N										
lb/ac in 0-24"	Rating									
20	VL	30	55	100	45	70	110	65	90	120
30	L	10	30	80	25	4				
40	M	0	10	60	5	3				
50	M	0	0	40	0	1				
60										
70										
80	V									
90	V									
100	V									

Appendix Table 2. Nitrogen recommendations for CPS and feed wheat (based on spring broadcast application)¹⁵.

Nitrogen Recommendation (lb/ac)										
SOIL MOISTURE CATEGORY		DRY			MOIST			IDEAL		
								50	55	60
								90	110	0
								70	90	0
								50	70	0
								30	50	80
								10	30	60
70	H	0	0	30	0	0	0	0	10	40
80	VH	0	0	10	0	0	0	0	0	20
90	VH	0	0	0	0	0	0	0	0	0
100	VH+	0	0	0	0	0	0	0	0	0

REPLACED

¹⁴ Manitoba Soil Fertility Advisory Committee, 1990.

		NITROGEN Guidelines (lb/ac)			
SOIL MOISTURE CATEGORY		ARID*	DRY*	MOIST*	High yield wheat**
TARGET YIELD (bu/ac)		35	45	65	85
Fall Soil NO ₃ -N Lb/ac in 0-24" Rating					2.0 lb N/bu
0	VL	50	130	140	170
10	VL	40	120	130	160
20	VL	30	110	120	150
30	L	20	100	110	140
40	M	10	90	100	130
50	M	0	80	90	120
60	H	0	70	80	110
70	H	0	60	70	100
80	VH	0	50	60	90
90	VH	0	40	50	80
100	VH+	0	30	40	70

Appendix Table 4. Nitrogen recommendations for barley (based on spring broadcast application)ⁱⁱⁱ.

SOIL MOISTURE CATEGORY		ARID*	DRY*	MOIST*
TARGET YIELD (bu/ac)		60	105	125
Fall Soil NO₃-N				
0	VL	90	90	140
10	VL	80	80	130
20	VL	70	70	120
30	L	60	60	110
40	M	50	50	100
50	M	40	40	90
60	H	30	30	80
70	H	20	20	70
80	VH	10	10	60
90	VH	0	0	50
100	VH+	0	0	40

Nitrogen \$ Rate of Return Calculator									
Manitoba (Moist)									
		Go to Marginal Revenue Chart		Go to Fertilizer Price as a Variable		Return to F			
		Go to Total Net Return Below Yield		Expected Barley Price					
				\$2.50	\$3.00	\$3.50	\$4.00	\$4.50	\$5.00
N Rate (lb./acre)	Average yield (bu./ac.)	Increase from 0 lb. N* (bu./ac.)	Net Return (\$/ac.)**						
			Barley:N Price Ratio						
			5.1	6.1	7.1	8.1	9.1	10.1	
60	108.5	42.5	\$76.6	\$97.8	\$119.0	\$140.3	\$161.5	\$182.7	\$203.9
70	113.0	47.0	\$82.8	\$106.3	\$129.8	\$153.3	\$176.8	\$200.3	\$223.8
80	116.7	50.7	\$87.3	\$112.6	\$138.0	\$163.4	\$188.7	\$214.0	\$239.3
90	119.7	53.7	\$89.9	\$116.7	\$143.6	\$170.5	\$197.3	\$225.0	\$252.7
100	122.0	56.0	\$90.6	\$118.6	\$146.6	\$174.6	\$202.6	\$230.6	\$259.6
110	123.5	57.5	\$89.5	\$118.2	\$147.0	\$175.8	\$204.5	\$233.4	\$262.4
120	124.3	58.3	\$86.5	\$115.7	\$144.8	\$174.0	\$203.2	\$233.2	\$262.0
130	124.4	58.4	\$81.7	\$110.9	\$140.1	\$169.3	\$198.4	\$227.6	\$256.4
140	123.7	57.7	\$75.0	\$103.9	\$132.7	\$161.6	\$190.4	\$219.0	\$248.0

*Yield responses are averages from 18-site years
 *Current N rate from your soil test report or common practice
 **Net Return = (barley price x yield increase) - (N price x N rate)
 Net return in blue represents maximum ± \$0.50 for the Barley:N Price Ratio range in this table and in Orange within \$1.00 of maximum

* With Barley at \$4/bu and N at \$0.50/lb N.

Appendix Table 7. Nitrogen recommendations for hybrid canola† (based on spring broadcast application)^{v, vi} /



NITROGEN RECOMMENDATION (lb/ac)			
TARGET YIELD (bu/ac)		MB	Nitrogen \$ Rate of Return Calculator Manitoba (All)
Fall Soil NO ₃ -N		52*	
lb/ac in 0-24"	Rating		Go to Marginal Revenue Chart Go to Fertilizer Price as variable Return to Data Entry Go to Total Net Return Below Expected Hybrid Canola Price
			Yield Increase from 0 lb. N* Net Return (\$/ac.)** Canola:N Price Ratio
			N Rate (lb./acre) Average yield (bu./ac.) Increase from 0 lb. N* (bu./ac.) \$9.50 \$10.00 \$10.50 \$11.00 \$11.50 \$12.00 \$12.50
0		190	19.2 20.2 21.3 22.3 23.3 24.3 25.3
10		180	\$94.7 \$102.3 \$109.9 \$117.5 \$125.0 \$132.6 \$140.2
20	VL	170	\$99.0 \$107.0 \$115.1 \$123.2 \$131.2 \$139.3 \$147.4
30	L	160	\$102.2 \$110.8 \$119.3 \$127.8 \$136.3 \$144.8 \$153.3
40	M	150	\$104.6 \$113.5 \$122.4 \$131.3 \$140.1 \$149.0 \$157.9
50	M	140	\$106.0 \$115.2 \$124.4 \$133.6 \$142.9 \$152.1 \$161.3
60	H	130	\$106.4 \$115.9 \$125.4 \$134.9 \$144.4 \$153.9 \$163.5
70	H	120	\$105.9 \$115.7 \$125.4 \$135.1 \$144.9 \$154.6 \$164.3
80	VH	110	\$104.5 \$114.4 \$124.3 \$134.2 \$144.2 \$154.1 \$164.0
90	VH	100	\$102.1 \$112.1 \$122.2 \$132.2 \$142.3 \$152.3 \$162.4
100	VH+	90	

*Yield responses are averages from 34-site years
 Current N rate from your soil test report or common practice
 **Net Return = canola price x yield increase) - (N price x N rate)
 Net return in blue represents maximum ± \$0.50 for the Canola:N Price Ratio range in this table and in Orange within \$1.00 of maximum

* With canola @ \$11/bu and N at \$0.50 per lb N.

Corn Fertility



John Heard
CROPS Branch

Table 1. Nitrogen fertilizer placement and timing in Manitoba for spring wheat, canola, soybeans and corn (based on % of acres or volume applied).STRATUS

Practice	Wheat	Canola	Soybeans	Grain corn
	% of acres or volume applied			
PLACEMENT				
Broadcast , no incorporation	0	2	0	11
Broadcast and incorporated	4	13	0	35
Preplant banded	52	40	0	39
Sidebanded	12	12	2	13
Mid row banded	17	19	1	3
Seed placed	13	11	1	2
In crop applied	2	2	1	22
TIMING				
Fall	45	34	1	32
Spring, preplant	11	13	0	48
At seeding	43	51	4	23
Post seeding, in crop	2	2	1	22

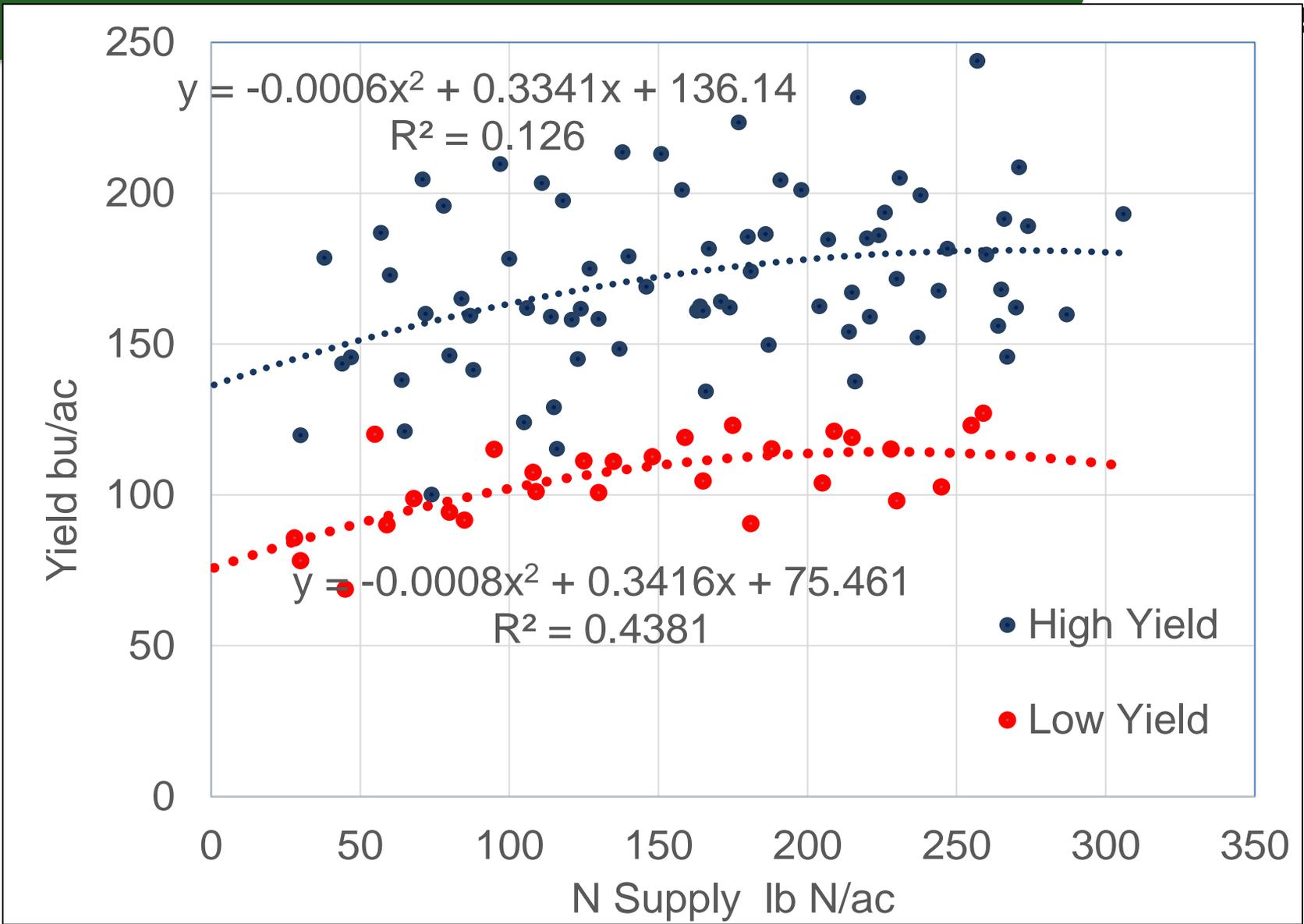


Figure 3. Grain corn response to nitrogen supply in 2001-17 (Heard, 2018⁴)

Appendix Table 9. Nitrogen recommendations for corn (based on a spring band application)^{13, 64}.

		NITROGEN RECOMMENDATION (lb/ac)			
TARGET YIELD (bu/ac)		85	100	115	130
SILAGE YIELD (t/ac)		12.6	14.9	17.1	19.4
Fall Soil NO ₃ -N					
lb/ac					
					220
					195
					170
					145
					120
70	H	0	5	50	95
80	VH	0	0	25	70
90	VH	0	0	0	50
100	VH+	0	0	0	25

REPLACED

Corn N Guidelines

- 1.2 lb N/bu – low-modest yields (100-125 bu/ac)
- 1.0 lb N/bu – yields >150 bu/ac
- Less soil N

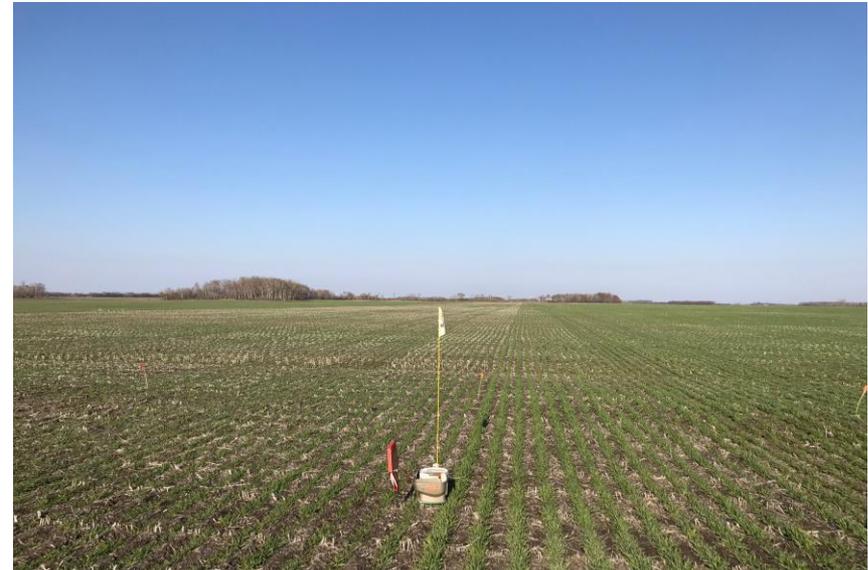
But Interim

- 17+ additional N rate sites from University of Manitoba in last 2 years (Gardner and Flaten, Tenuta)

What about fall rye?

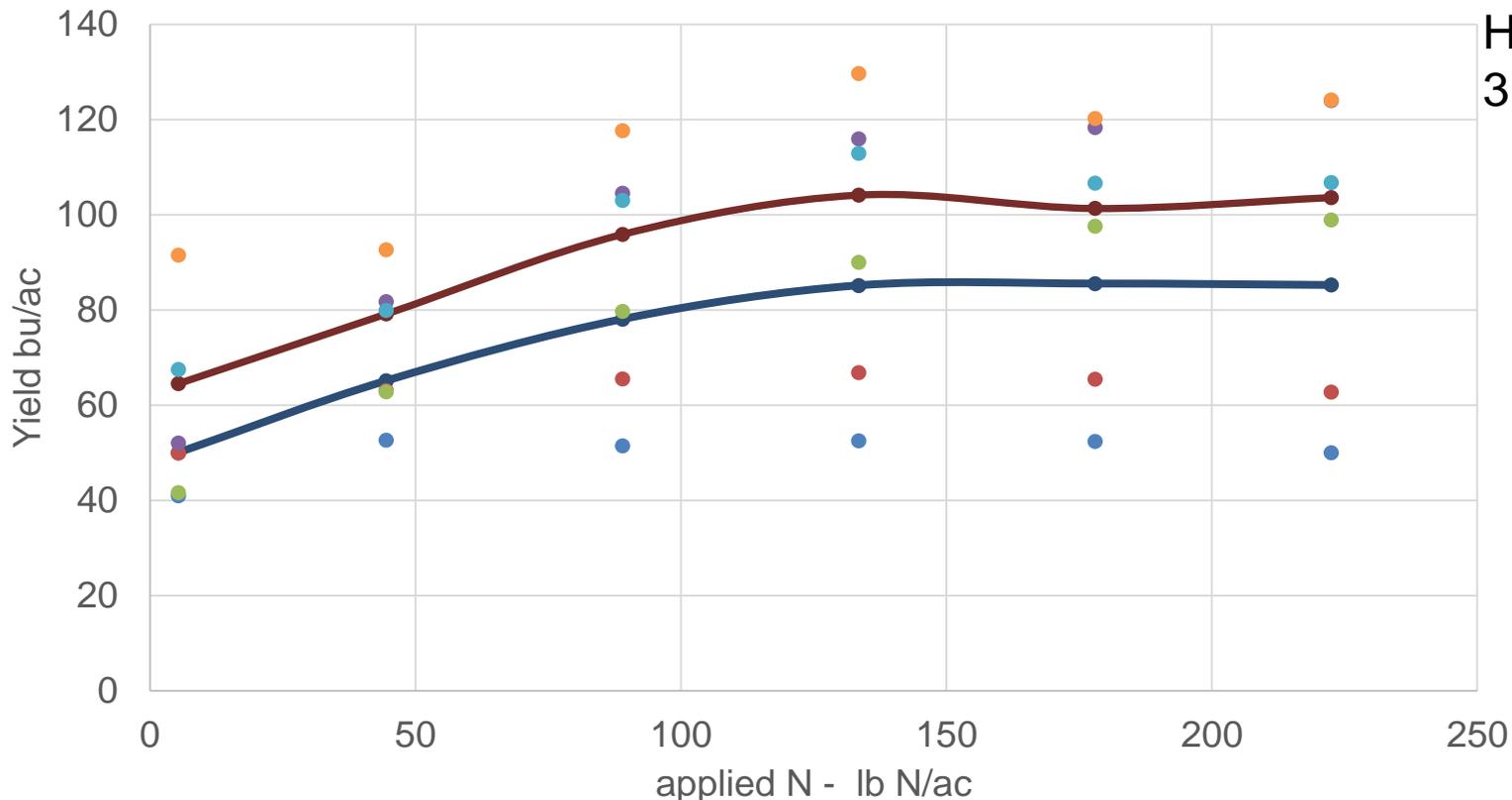
No current Soil Fertility Guide N recommendation with soil test:

- 40-65 lb N/ac
- Strong interest in hybrid rye with higher yield potential, shorter straw, better lodging tolerance
- But very limited yield data
- “fertilize with 20% less N than needed for comparable wheat yields.”
- Interim guideline?



Rye response to applied N

IHARF – Chris Holzapfel
3 site-yrs



- OP IH-15 ● HB IH-15 ● OP IH-16
- HB IH-16 ● OP M-16 ● HB M-16

About 30 lb soil N (28-34 kg/ha)

	Yield	N supply	Ib N/bu
OP	85	164	1.93
Hyb	104	164	1.58

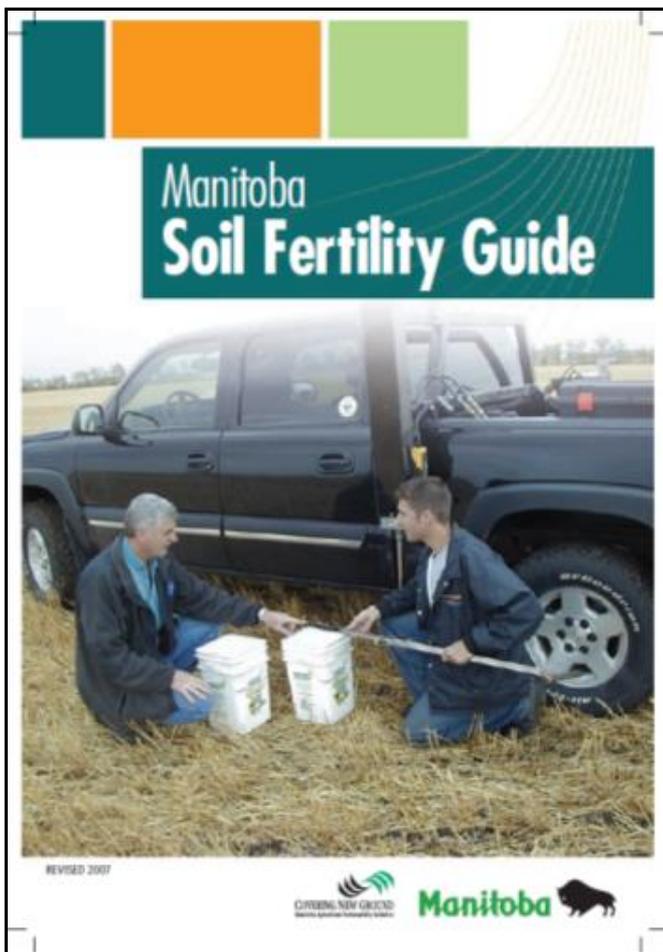
Appendix Table. Interim Nitrogen recommendations for hybrid and open pollinated (OP) fall rye based on a spring broadcast application.

		Open pollinated @ 1.9 lb N/bu			Hybrid @ 1.6 lb N/bu		
Target Yield bu/ac		40	60	80	60	80	100
Soil nitrate-N lb N/ac in 0-24" Rating		Nitrogen suggestion (lb N/ac)					
0	VL	75	115	150	105	130	160
10	VL	65	105	140	95	120	150
20	VL	55	95	130	85	110	140
30	L	45	85	120	75	100	130
40	M	35	75	110	65	90	120
50	M	25	65	100	55	80	110
60	H	15	55	90	45	70	100
70	H	5	45	80	35	60	90
80	VH	0	35	70	25	50	80
90	VH	0	25	60	15	40	70
100	VH+	0	15	50	5	30	60

N requirement for hybrid fall rye = 1.6 x yield goal – soil N

N requirement for OP fall rye = 1.9 x yield goal – soil N

Developing Phosphorus Rate Options



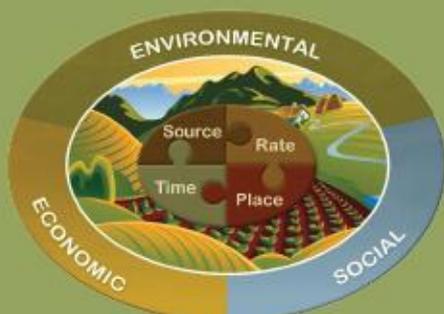
Appendix Table 17. Phosphorus recommendations for field crops based on soil test levels and

FERTILIZER PHOSPHATE (P ₂ O ₅) RECOMMENDED (lb/ac)												
Soil Phosphorus (sodium bicarbonate or Olsen P test)			Cereal	Corn Sunflower	Canola Mustard Flax		Buckwheat Fababeans		Potatoes		Peas Lentils Field beans ¹ Soybeans ¹	
ppm	lb/ac	Rating	S ¹	Sb ²	B ³	S ¹	B ³	S ¹	B ³	PP ⁴	B ³	S ¹
0	0	VL	40	40	40	20	40	20	55	110	40	20
	5	VL	40	40	40	20	40	20	55	110	40	20
5	10	L	40	40	40	20	40	20	50	100	40	15
	15	L	35	35	35	20	35	20	45	90	35	15
10	20	M	30	30	30	20	30	20	45	90	30	10
	25	M	20	20	20	20	20	20	40	80	20	10
15	30	H	15	15	15	0	15	20	35	70	15	0
	35	H	10	10	10	0	10	20	30	60	10	0
20	40	VH	10	10	10	0	10	20	30	60	10	0
20+	40+	VH+	10	10	10	0	10	20	30	60	10	0

Review by Grant and Flaten

- P fertility declining on Prairie soils under current sufficiency approach
- Yield potential is greater on high P soils
- Desirable STP target 10-20 ppm Olsen
- Buffering capacity – to build STP ranges 20-37 lb P₂O₅/ac above removal
- Removal values

4R Management of Phosphorus Fertilizer
in the Northern Great Plains:
A Review of the Scientific Literature



The diagram illustrates the 4R (Right Source, Right Rate, Right Time, Right Place) management of phosphorus fertilizer. It features a central circular graphic divided into four quadrants labeled 'Source', 'Rate', 'Time', and 'Place'. This central graphic is surrounded by three concentric rings representing the '4R' pillars: 'ENVIRONMENTAL' (top, green), 'ECONOMIC' (left, yellow), and 'SOCIAL' (right, blue). The background of the diagram shows a rural landscape with fields and mountains.

July 3, 2019

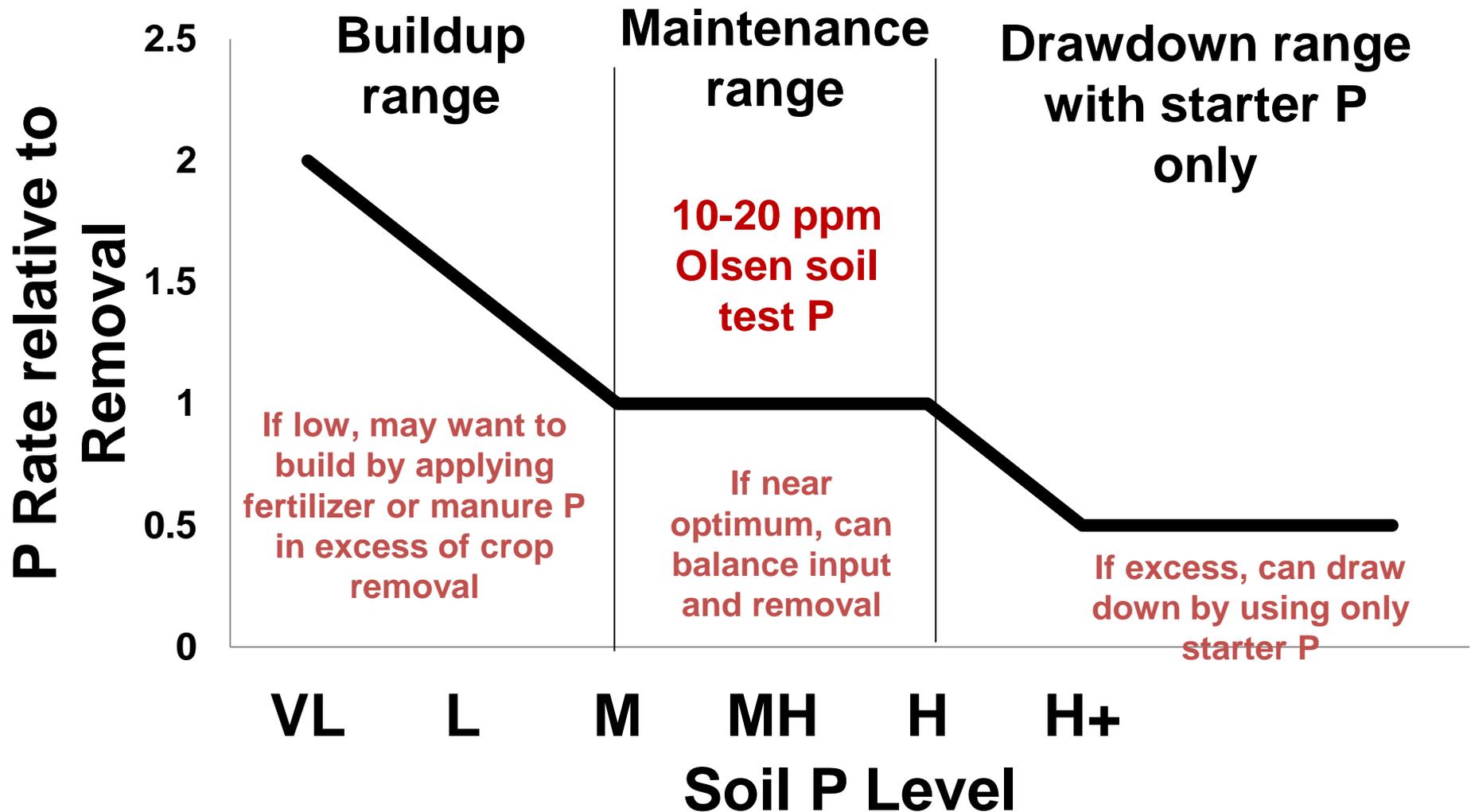
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 nutrient
stewardship

 IPNI
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Coming up with a P rate?

(K-State, Ontario)

$$\text{Application rate} = \frac{(\text{Target STP} - \text{Current STP}) \times \text{BC}}{\text{Years to Build}} + \text{CR}$$

Example: for 60 bu/ac wheat

- Target STP = 15 ppm, current STP = 5 ppm
- Buffering Capacity (BC) by soil characteristics (assuming 25 lb P₂O₅ /ac to increase 1 ppm STP)
- Crop removal (CR) = yield x P concentration = 60 bu/ac x 0.6 lb P₂O₅/bu
- Years to Build = 5

$$= \frac{(15-5) \times 25}{5} + 36 = \frac{(250)}{5} + 36 = 86 \text{ lb P}_2\text{O}_5 \text{ ac}$$

Proposal

Offer farmers two options for fertilizing (like K-State)

1. Short-term Sufficiency
2. Long-term Sustainability (Build-Maintain-Drawdown)

SHORT TERM SUFFICIENCY APPROACH which:

- offers good short-term returns on P application
- generally leads to P deficiency with STP stabilizing in the low category over the long-term.
- appropriate for short-term management of rented land, short land tenure or years with poor crop prices and/or high fertilizer P costs.
- no recent research would support increasing these rates.

LONG TERM SUSTAINABLE APPROACH

which:

- should be considered an investment in long-term productivity.
- is not intended to provide optimum economic returns in a given year but to minimize the probability of P limiting yields by providing high yield potential.
- builds low STP, maintains medium STP level with removal rates, and draws down very high STP by using starter P rates (perhaps 1/3 to 1/2 crop removal) with STP levels eventually stabilizing in that medium-high range
- Regular soil testing to monitor progress.
- Approach should be flexible and modified for grower's economic situation, farm goals, land tenure, soils, yield levels and time frame.

Proposed Options

Soil test Olsen P ppm	Short Term Sufficiency	Long Term Sustainability*			
	Wheat, Canola Oats, Soybeans	Wheat	Canola	Oats	Soybeans
	lb P ₂ O ₅ /ac				
0	40	110	110	110	105
5	40	85	85	85	80
10	30	60	60	60	55
15	15	35	35	35	30
20	10	10	10	10	0
20+	10	10	10	10	0

* Based on average crop yields, BC of 25 lb P₂O₅/ 1 ppm STP, 5 year build up period

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Normal Bad Good Neutral Calculation Check Cell

K19												
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1	Phosphorus Balance Calculation for a Rotation (Version 4 - October 1, 2014)						
2	Crop	Typical Yield	Yield Units	P Applied	P Removed* per unit	per acre	Annual Balance
3	----- (lb P ₂ O ₅ /ac) -----						
4	HR Spring wheat	60	bu/ac	30	0.59	35	-5
5	Winter wheat	75	bu/ac	30	0.51	38	-8
6	Barley		bu/ac		0.42	0	0
7	Oats		bu/ac		0.26	0	0
8	Canola	40	bu/ac	20	1.04	42	-22
9	Soybeans	40	bu/ac	10	0.84	34	-24
10	Peas		bu/ac		0.69	0	0
11	Flax		bu/ac		0.65	0	0
12	Corn (grain)		bu/ac		0.44	0	0
13	Other**				0.00	0	0
14	Total for Rotation			90		149	-59

Notes: Does not account for nutrients removed when straw or chaff is removed or burned

16 Fill in any of the blue cells for typical rotation, yields, and P appl'n

17 *P removal figures are estimates from the Manitoba Soil Fertility Guide.

18 **For nutrient removal in other crops see table in next worksheet.

19 <https://www.gov.mb.ca/agriculture/crops/soil-fertility/phosphorus-balance-calculator-for-a-rotation.html>

Biofertilizers and Biostimulants

A biofertilizer is a formulated product containing one or more microorganisms that may enhance the nutrient status (and the growth and yield) of plants by either replacing soil nutrients and/or by making nutrients more available to plants and/or by increasing plant access to nutrients.

A plant biostimulant is any substance or microorganism applied to plants with the aim to enhance nutrition efficiency, abiotic stress tolerance and/or crop quality traits, regardless of its nutrient content.

The Fertilizers Act

The Fertilizers Act

Fertilizers (substances containing plant nutrients) and supplements (products other than fertilizers that improve the physical condition of the soil or aid plant growth and crop yield) when imported and sold in Canada are regulated by the Canadian Food Inspection Agency (CFIA) under the [Fertilizers Act](#) and [Fertilizers Regulations](#).

The Fertilizers Act and Regulations requires that all regulated fertilizer and supplement products:

- must be safe for humans, plants, animals, and the environment.
- must also be properly labelled to ensure safe and appropriate use.

Regulated products include farm fertilizers, micronutrients, lawn and garden products as well as supplements such as water holding polymers, microbial inoculants, plant growth regulators, liming materials, and waste-derived materials such as composts and municipal biosolids. Some fertilizers and most supplements are subject to registration and require a comprehensive pre-market assessment **prior** to their import or sale in Canada. Products that are exempt from registration are still subject to regulation and must meet all the prescribed standards at the time of sale or import.

Additional information can be obtained from CFIA at: <http://www.inspection.gc.ca/plants/fertilizers/program-overview/eng/1330891097865/1330891293225>

So – complete an on-farm-test following “**Protocols for Field-Scale Evaluations of Biofertilizers and Biostimulants Applied to Enhance Nutrient Use Efficiency of Grain Crops**” as proposed by Nutrient Star.

. https://nutrientstar.org/wp-content/uploads/2019/04/Protocols_field_scale_biological_evaluations.pdf

Biofertilizer/ Biostimulant testing

Evaluate product based on the advertised claims about the benefits of the product.

- if a product is advertised to lower the rate of fertilizer, the product should be evaluated with a rate of fertilizer that is lower than the farmer typically applies with 50-70% of normal a good target;
- if a product is advertised to enhance yield at a full rate of fertilizer, the product should be evaluated at a full rate of fertilizer application.

On –Farm-test Design

Block 1	Standard
	Fertilizer A
Block 2	Standard
	Fertilizer A
Block 3	Fertilizer A
	Standard
Block 4	Standard
	Fertilizer A

- Other measurements – yield, quality, pests, etc.
- Ask for help: crop commodity associations, crop advisers
- Statistically analyse results, combine with others

Summary

1. Revision of N rates for wheat, corn and fall rye.

Approach – realistic yields and lb N/bu

Others – oats?

2. The P Conversation: rate options, timing and placement

3. Biofertilizers and Biostimulants: the validation testing is in the hands of growers and their advisors