WESTERN AG

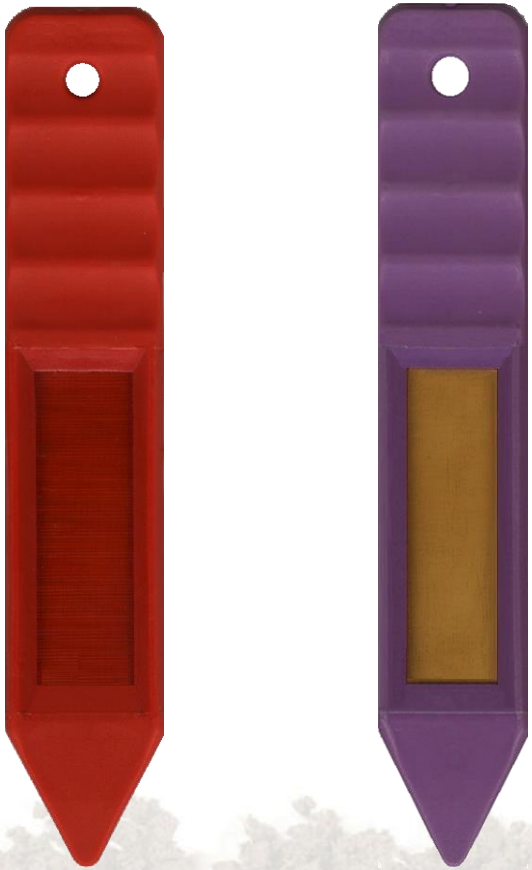
Fall 2018 soil nutrient supply rates, what do the trends show?

Edgar Hammermeister, PAg

2019 Soils and Crops Conference

Plant Root Simulator (PRS®) Probes

Anion probe



Cation probe

College of Agriculture and Bioresources

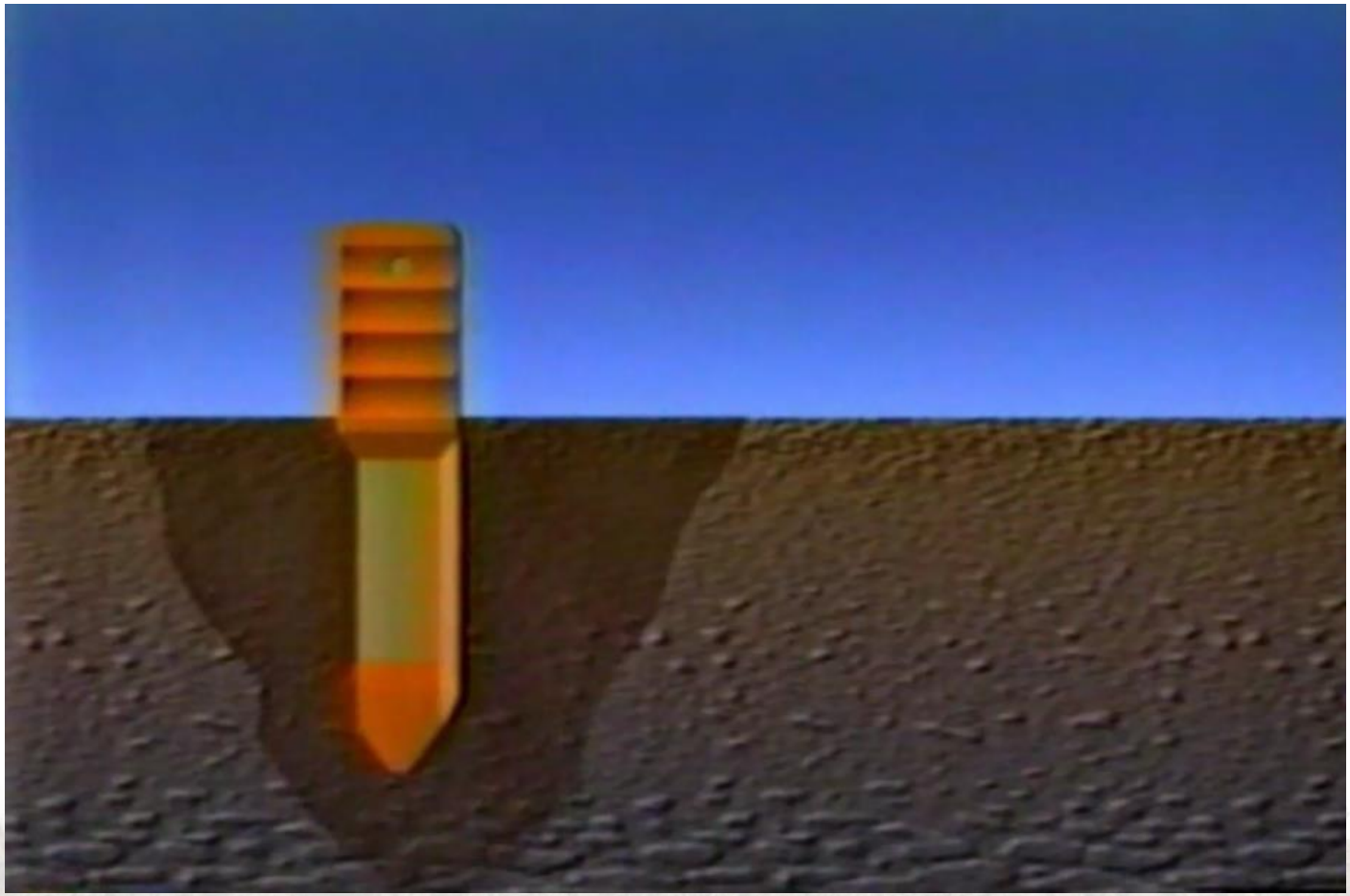
Inventor:
Dr. Jeff Schoenau,
Professor and Ministry of Agriculture Strategic Research Chair

US patent #6,242,261

Patented in Australia, Canada, Europe, New Zealand and the United States.

PRS Probes

Patented technology that adsorbs nutrients like a plant root.



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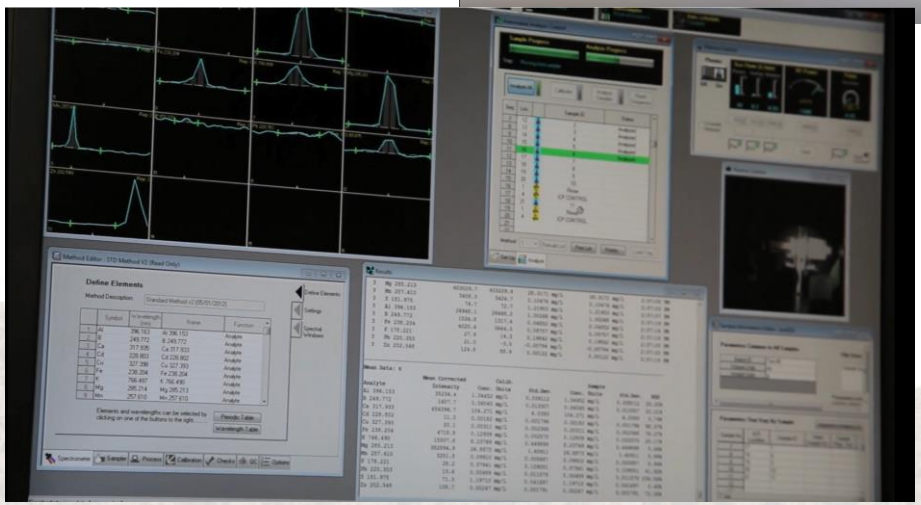
WESTERN AG INNOVATIONS

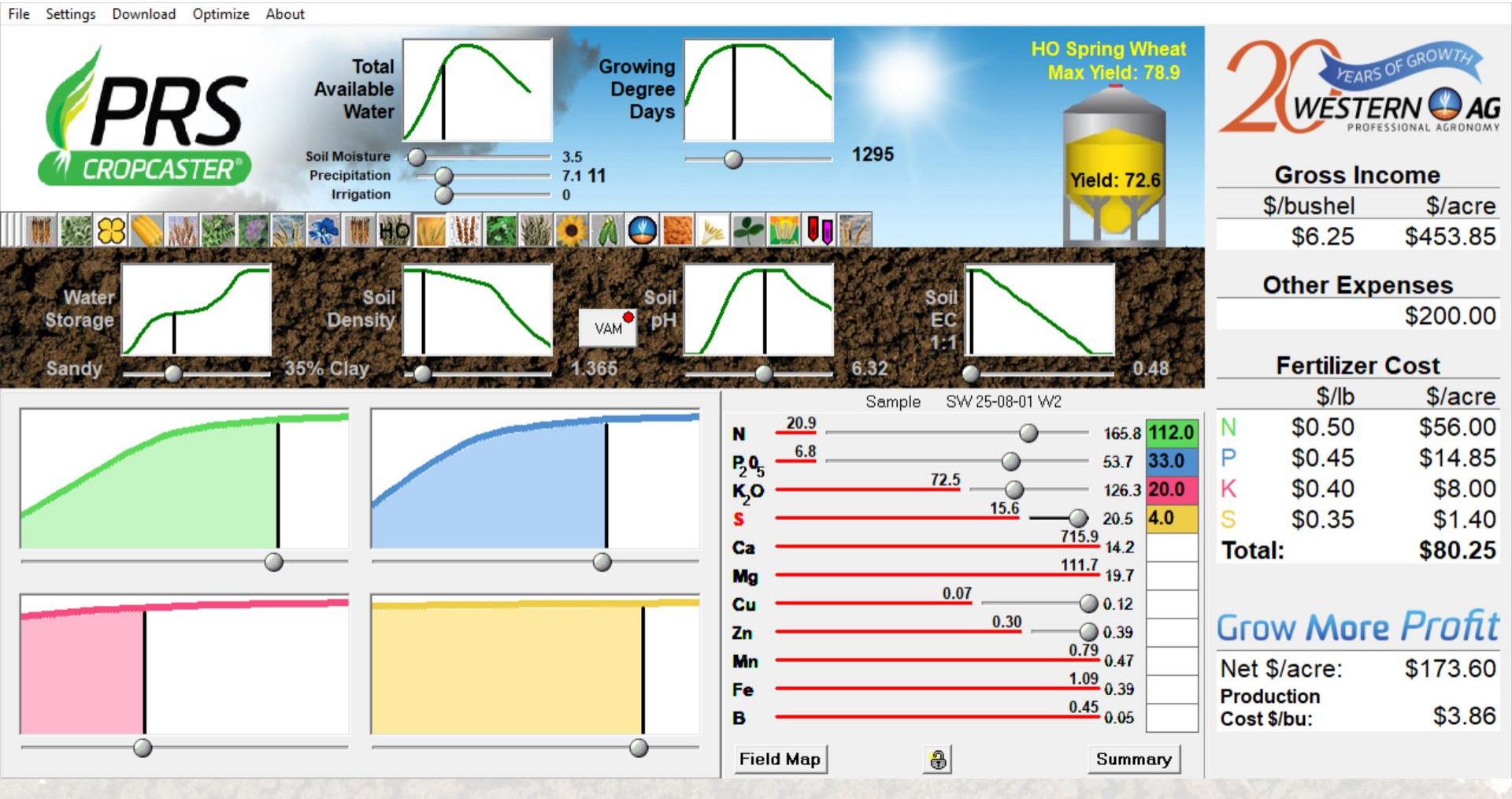
20 YEARS OF GROWTH
WESTERN AG
PROFESSIONAL AGRONOMY

PRS® Probes as used in the lab.

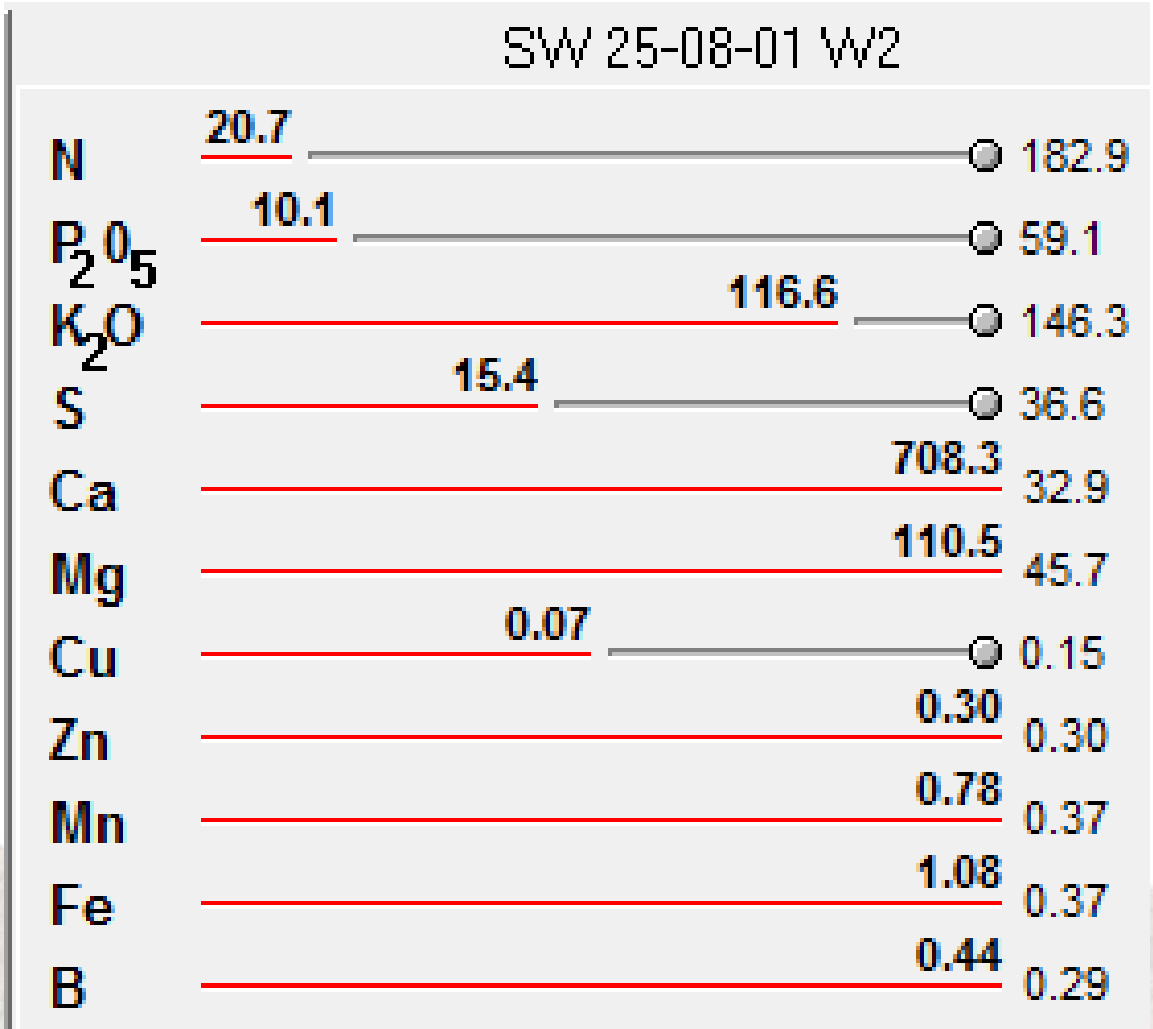
For agriculture purposes, the soil sample is wet to field capacity, warmed to room temperature, and probed for 24 hours.

The soil supply rate of nutrients is measured under standardized conditions to limit variability.

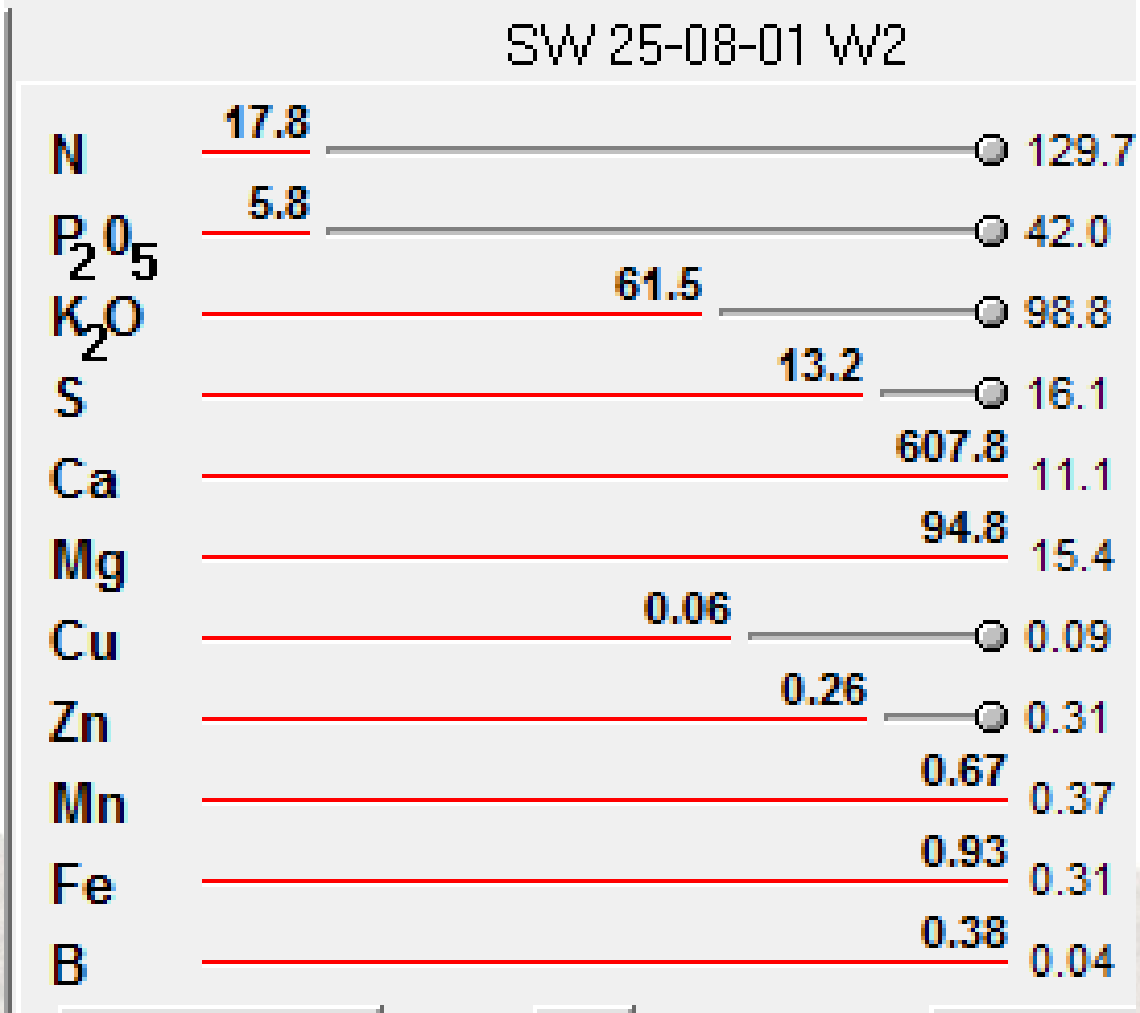



File Settings Download Optimize About
PRS CROPCASTER
Total Available Water
Growing Degree Days
HO Spring Wheat
Max Yield: 78.9
Soil Moisture 3.5
Precipitation 7.1 11
Irrigation 0
1295
Yield: 72.6
HO
Water Storage
Soil Density
VAM
Soil pH
Soil EC 1:1
Sandy
35% Clay
1.365
6.32
0.48
Sample SW 25-08-01 W2
N 20.9 165.8 112.0
P2O5 6.8 53.7 33.0
K2O 72.5 126.3 20.0
S 15.6 20.5 4.0
Ca 715.9 14.2
Mg 111.7 19.7
Cu 0.07 0.12
Zn 0.30 0.39
Mn 0.79 0.47
Fe 1.09 0.39
B 0.45 0.05
Field Map
Summary
20 YEARS OF GROWTH
WESTERN AG
PROFESSIONAL AGRONOMY
Gross Income
$/bushel $/acre
$6.25 $453.85
Other Expenses
$200.00
Fertilizer Cost
$/lb $/acre
N $0.50 $56.00
P $0.45 $14.85
K $0.40 $8.00
S $0.35 $1.40
Total: $80.25
Grow More Profit
Net $/acre: $173.60
Production Cost $/bu: $3.86

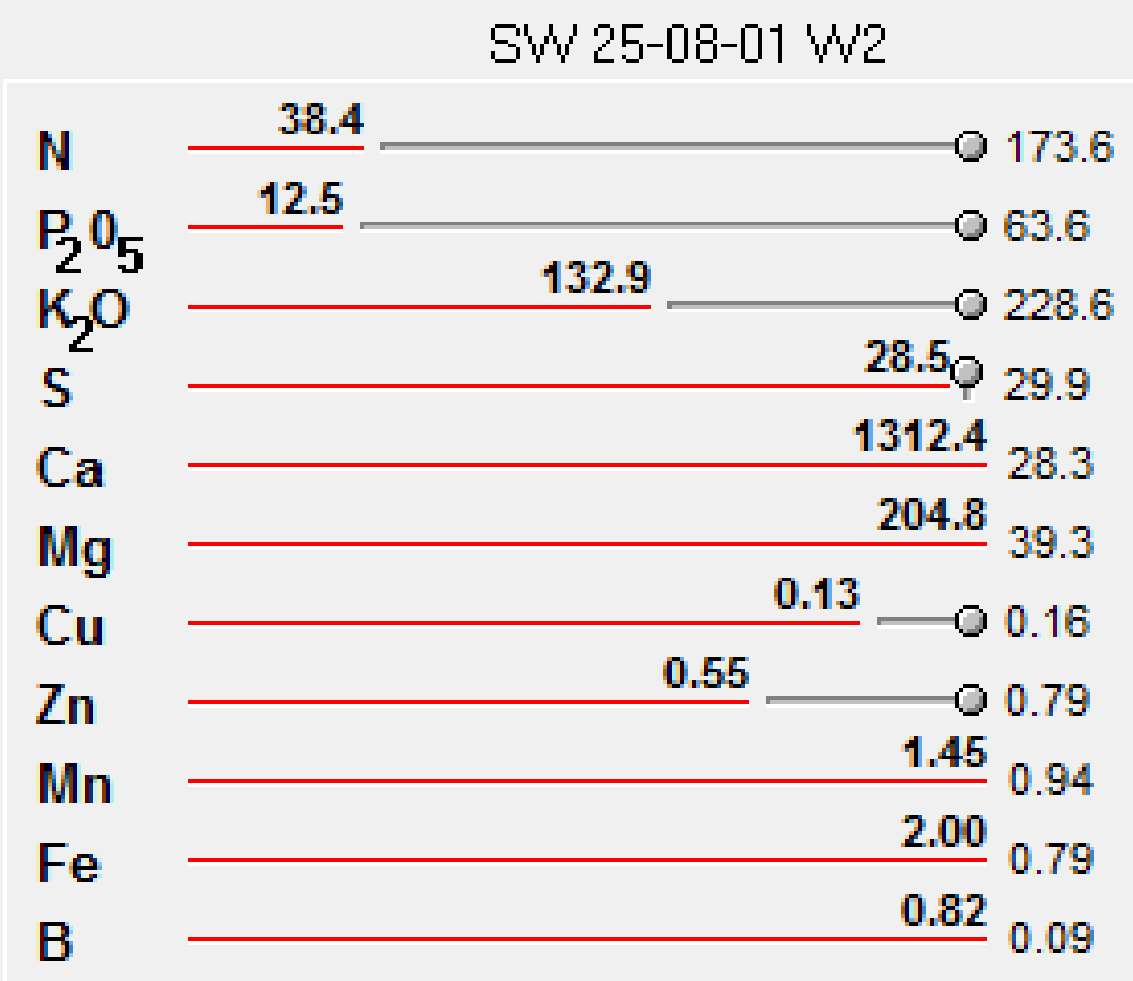
Different rooting characteristics, different supply rates – Canola.



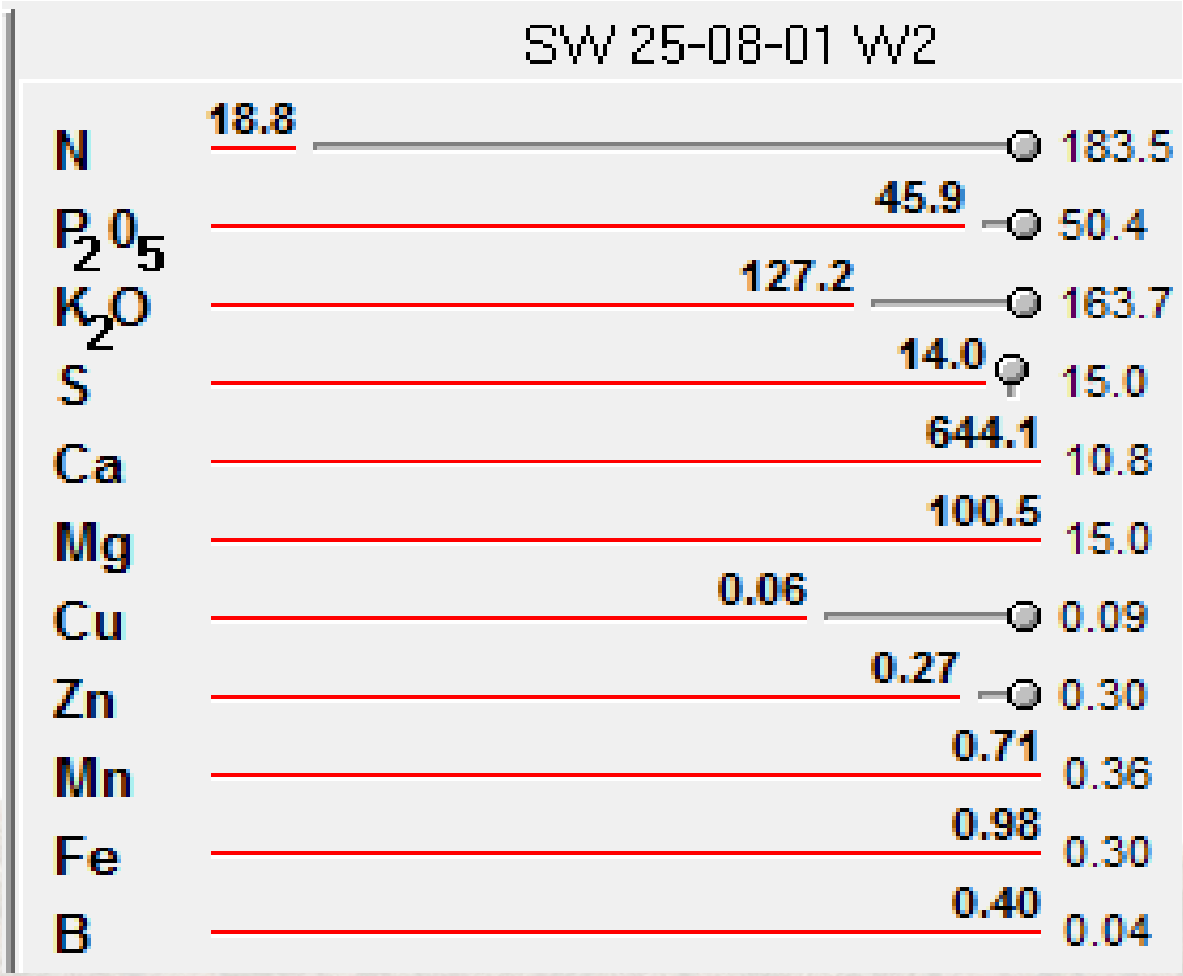
Different rooting characteristics, different supply rates – Wheat.



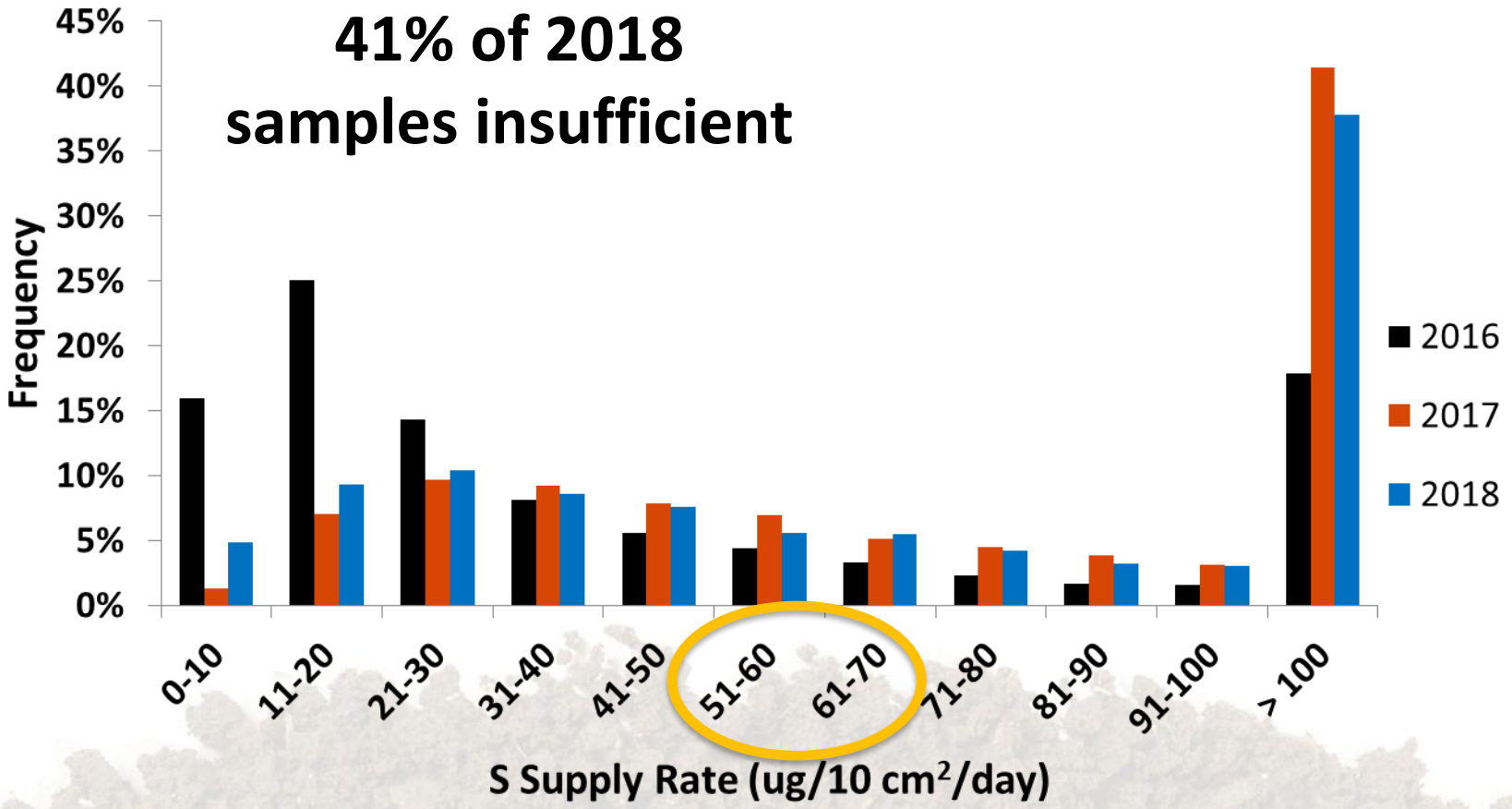
Different rooting characteristics, different supply rates - Oats



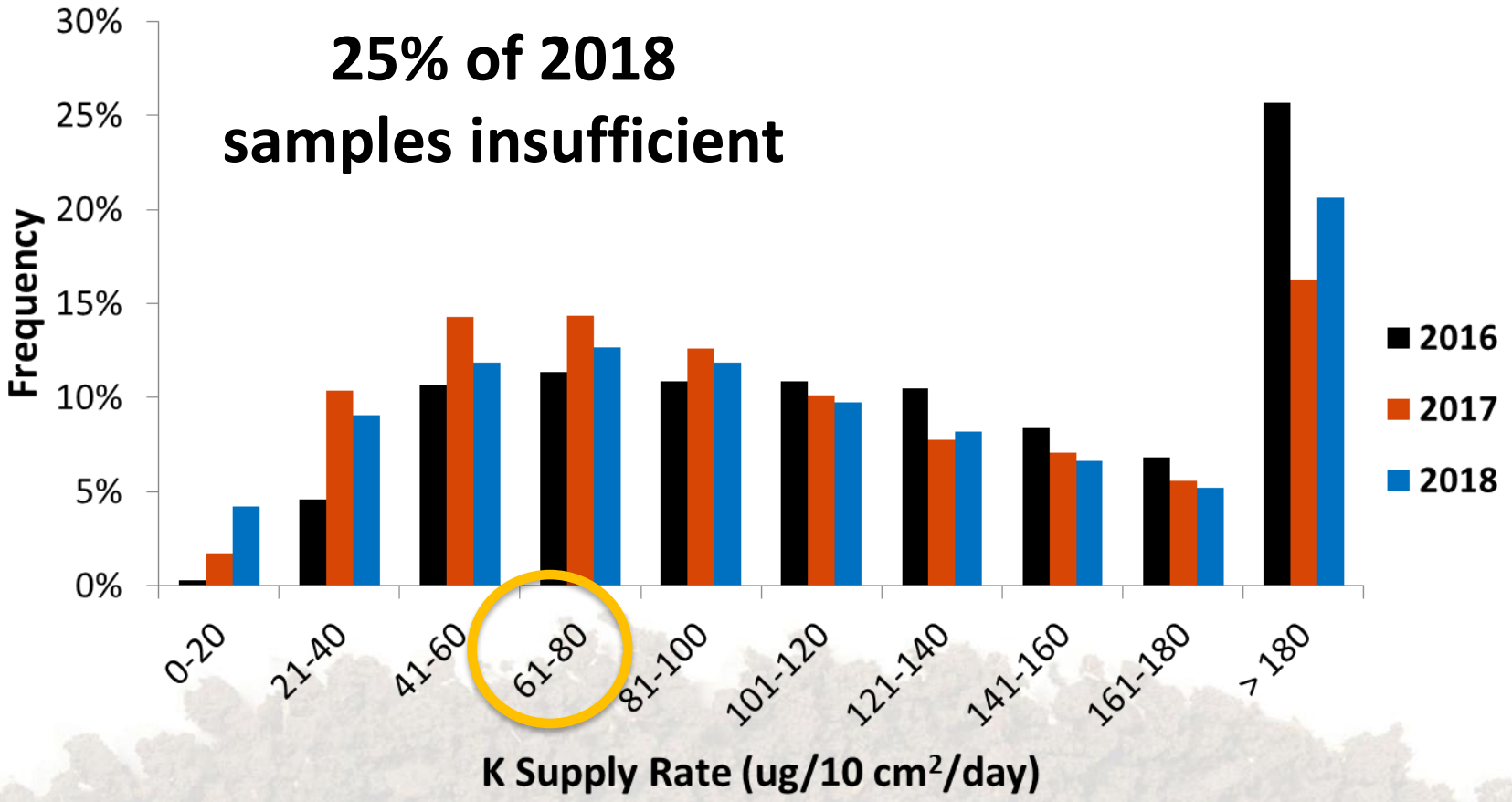
Different rooting characteristics, different supply rates – Peas.



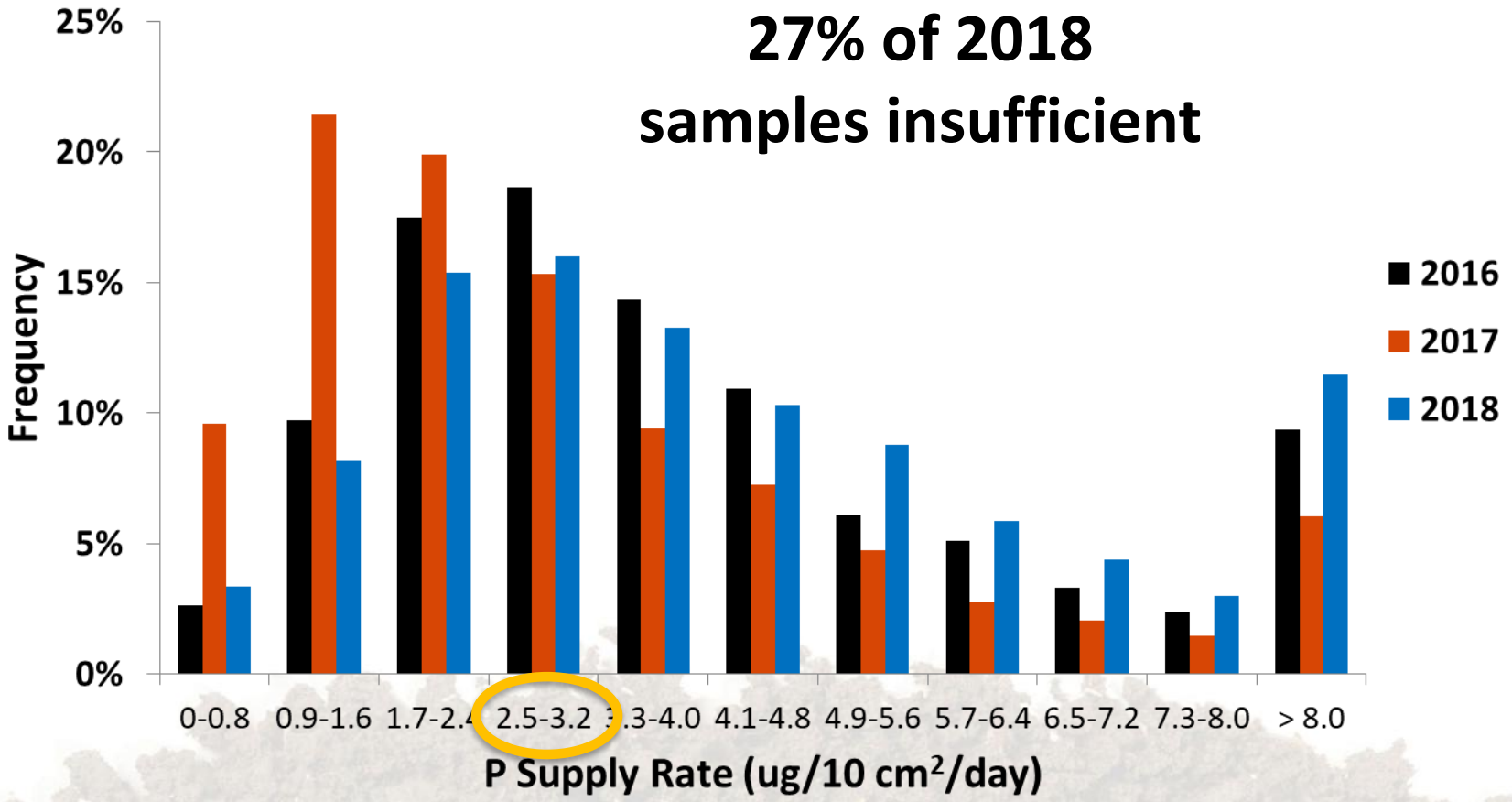
Three Year Trend Comparison
Sulphur Supply Rate



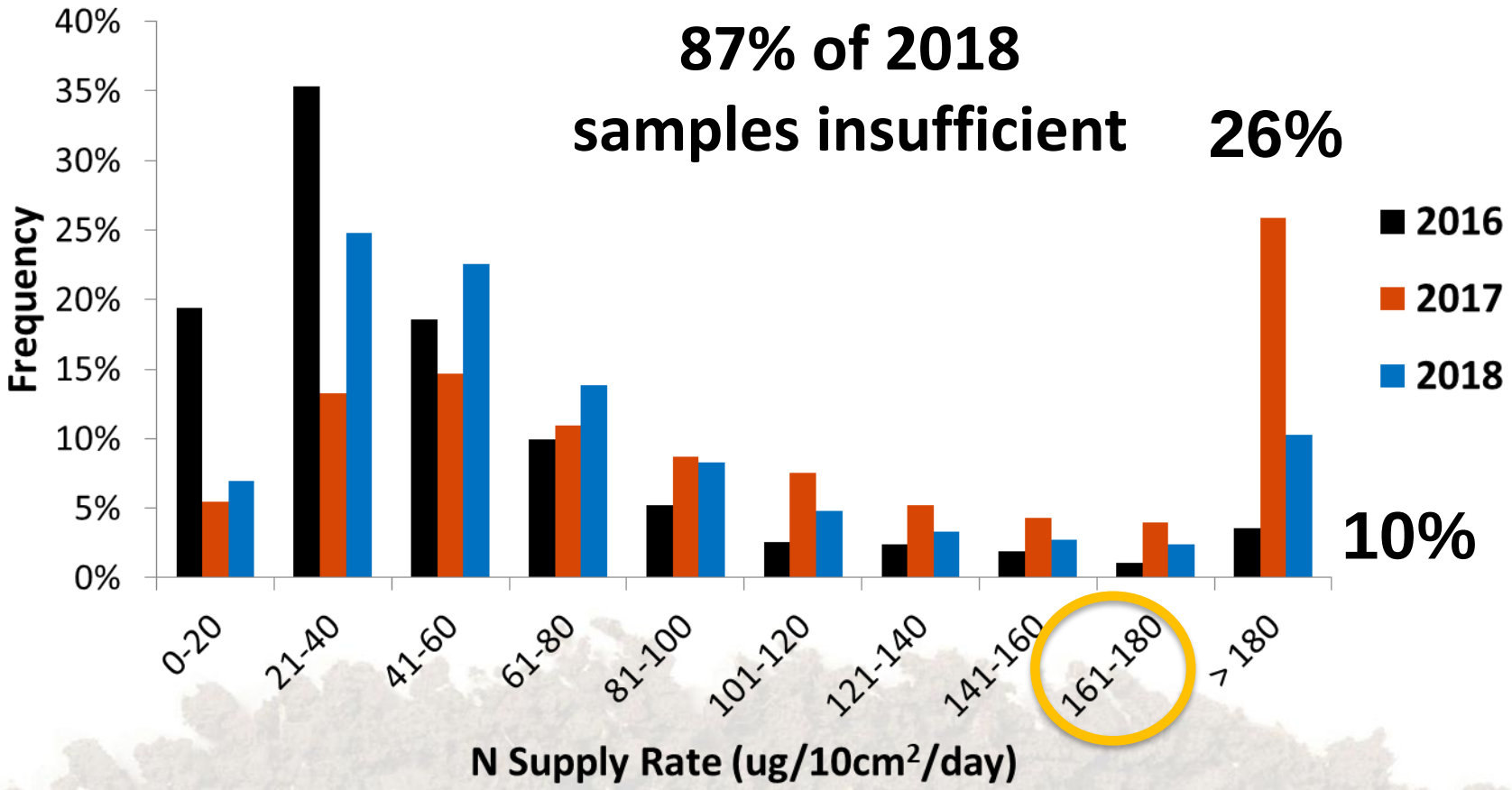
Three Year Trend Comparison
Potassium Supply Rate



Three Year Trend Comparison Phosphorus Supply Rate



Three Year Trend Comparison Nitrogen Supply Rate

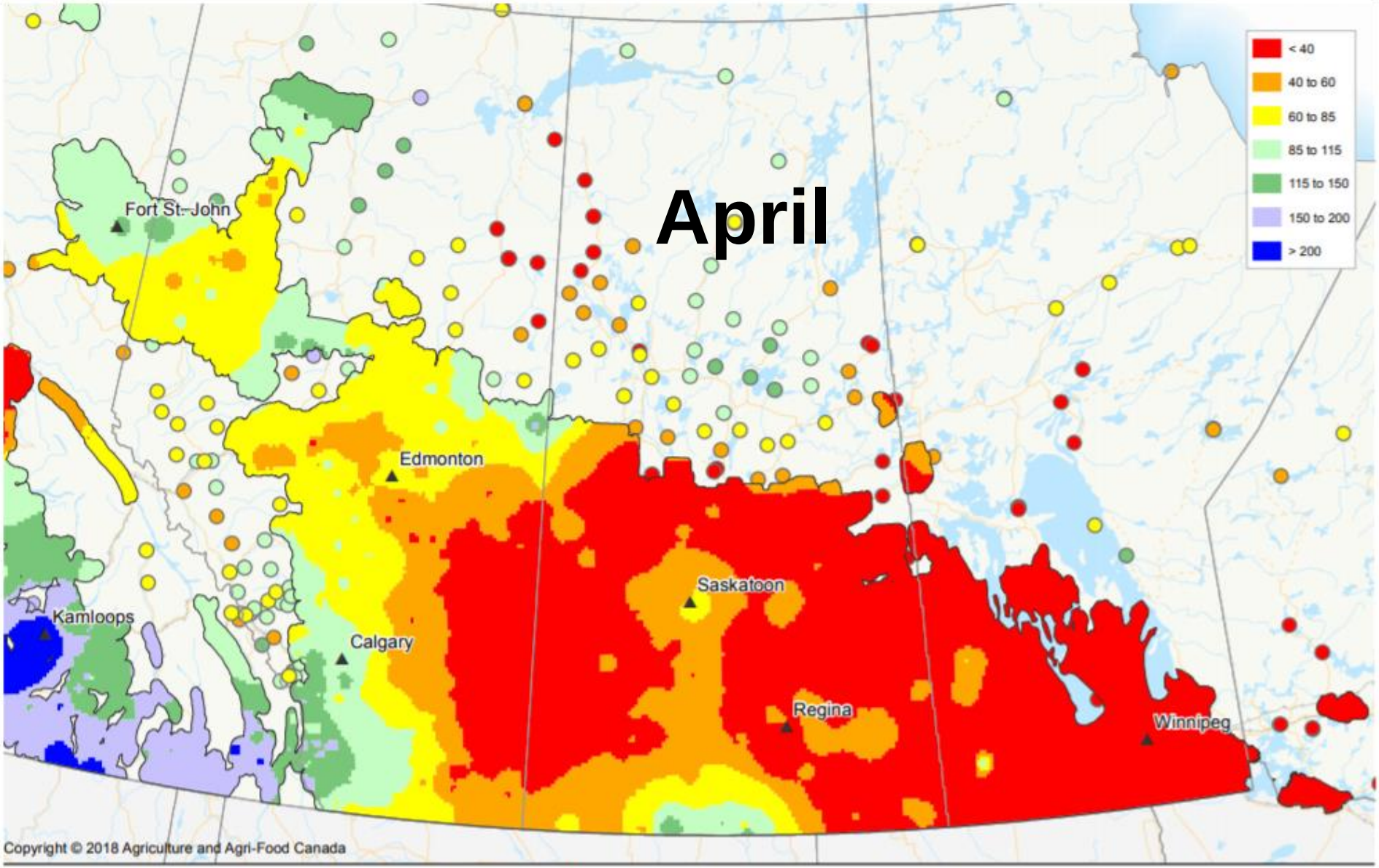


Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Canada

Percent of Average Precipitation

April 1, 2018 to April 30, 2018



Prepared by Agriculture and Agri-Food Canada's Science and Technology Branch. Data provided through partnership with Environment Canada, Natural Resources Canada, Provincial and private agencies.
Produced using near real-time data that has undergone some quality control. The accuracy of this map varies due to data availability and potential data errors.

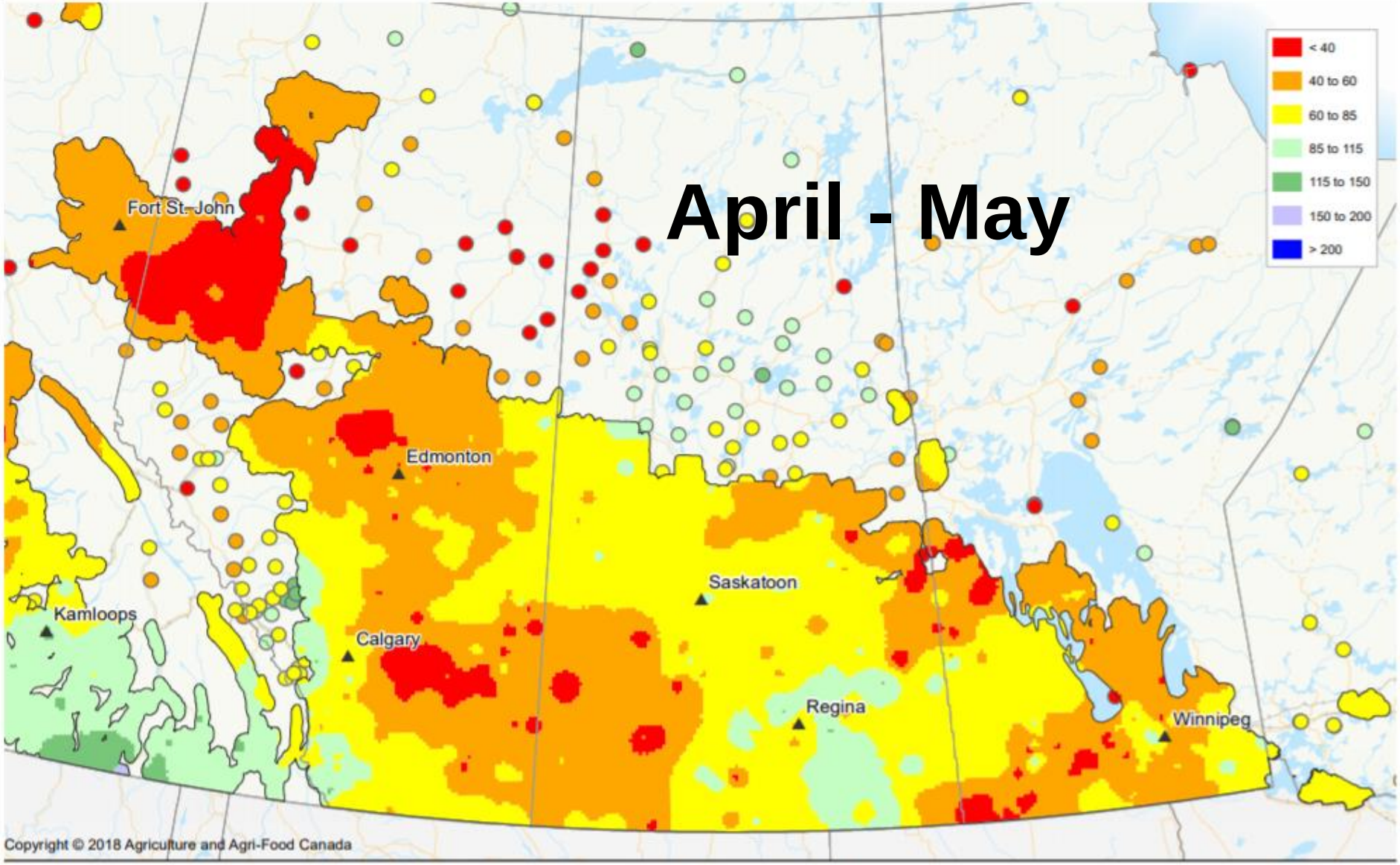
Created: 2018-05-01
www.agr.gc.ca/drought

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Canada

Percent of Average Precipitation

April 1, 2018 to May 31, 2018



Prepared by Agriculture and Agri-Food Canada's Science and Technology Branch. Data provided through partnership with Environment Canada, Natural Resources Canada, Provincial and private agencies.
Produced using near real-time data that has undergone some quality control. The accuracy of this map varies due to data availability and potential data errors.

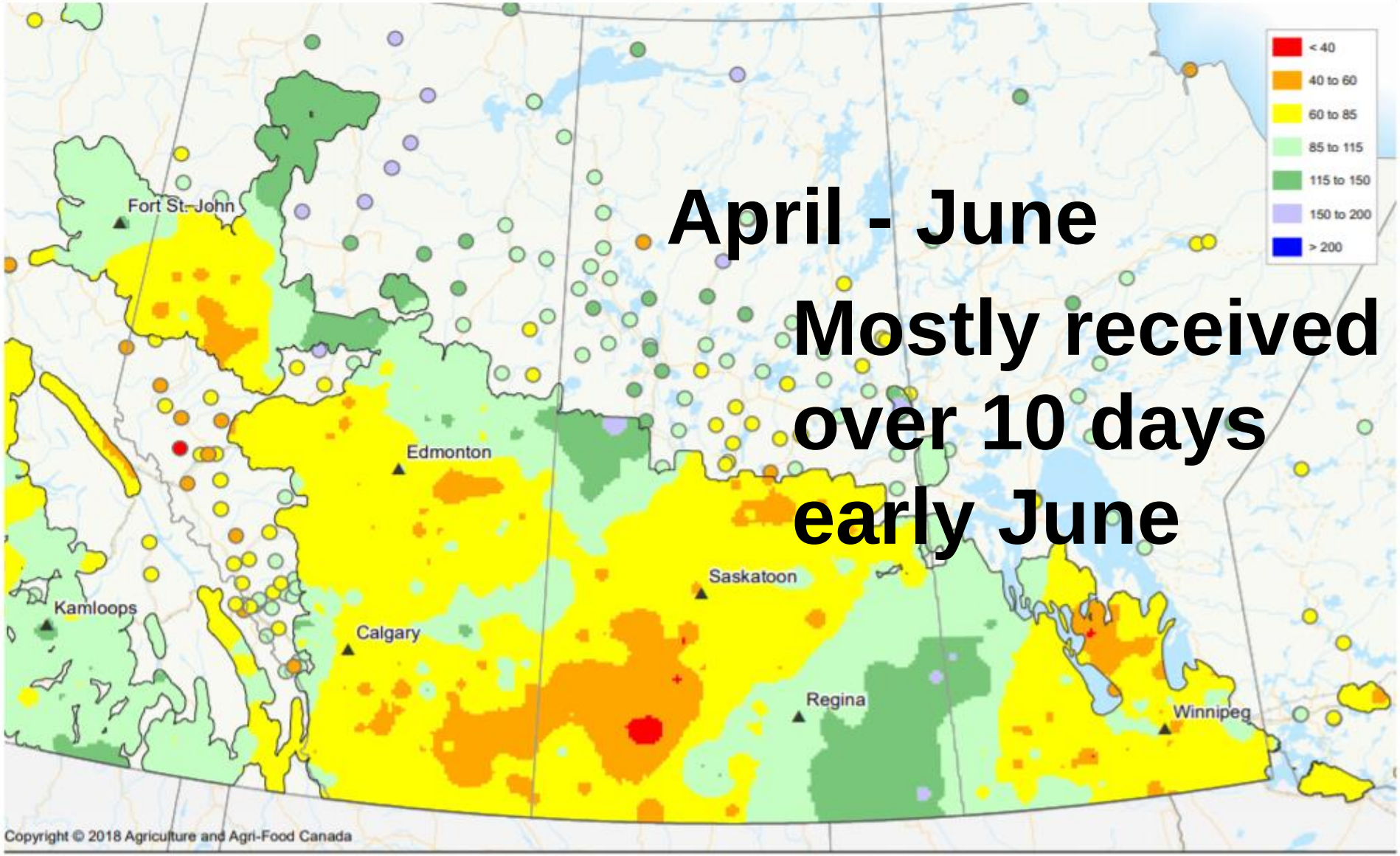
Created: 2018-06-19
www.agr.gc.ca/drought

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Canada

Percent of Average Precipitation

April 1, 2018 to June 30, 2018



Prepared by Agriculture and Agri-Food Canada's Science and Technology Branch. Data provided through partnership with Environment Canada, Natural Resources Canada, Provincial and private agencies.
Produced using near real-time data that has undergone some quality control. The accuracy of this map varies due to data availability and potential data errors.

Created: 2018-07-03
www.agr.gc.ca/drought

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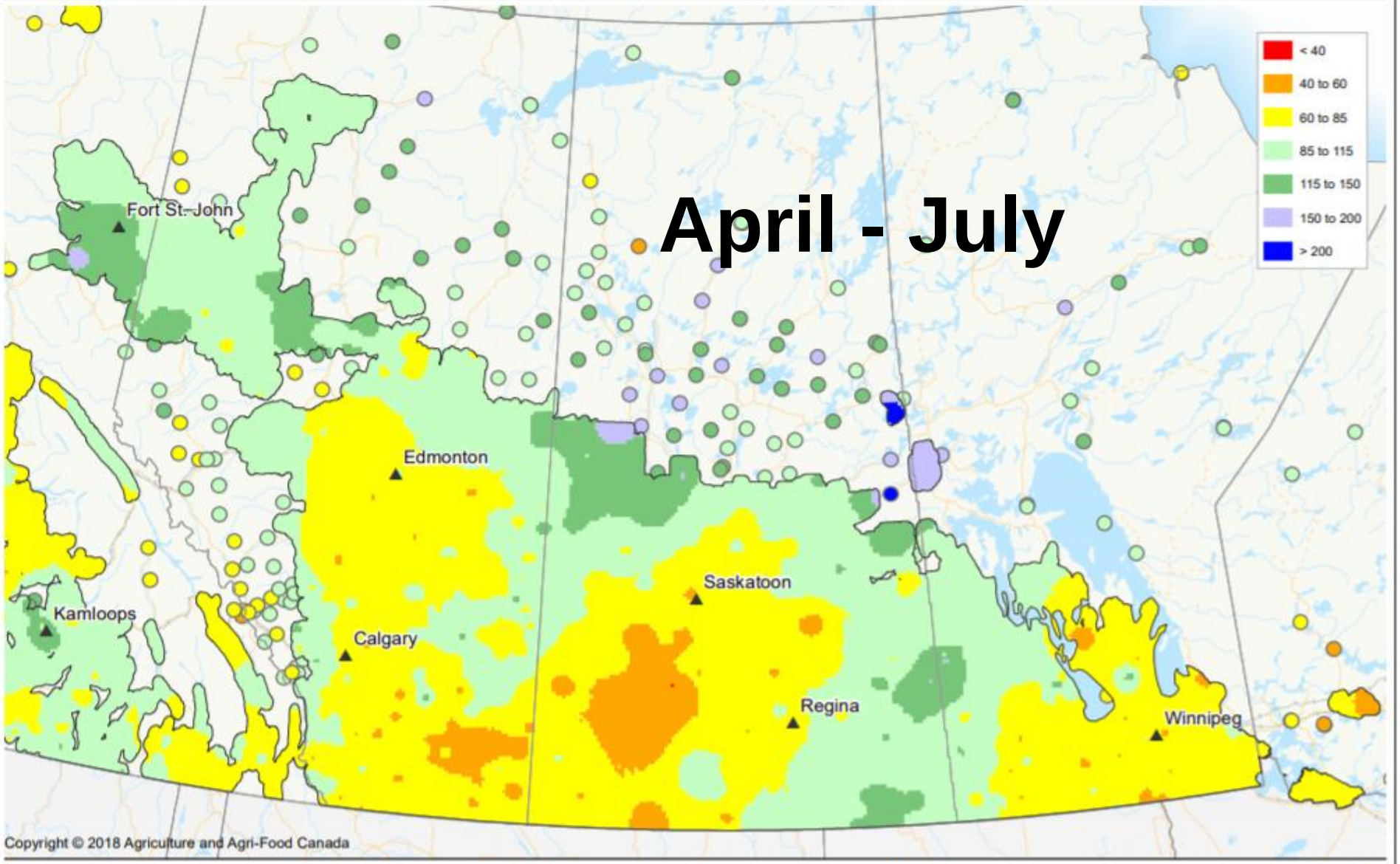
Canada

Percent of Average Precipitation

April 1, 2018 to July 31, 2018



Prepared by Agriculture and Agri-Food Canada's Science and Technology Branch. Data provided through partnership with Environment Canada, Natural Resources Canada, Provincial and private agencies.
Produced using near real-time data that has undergone some quality control. The accuracy of this map varies due to data availability and potential data errors.

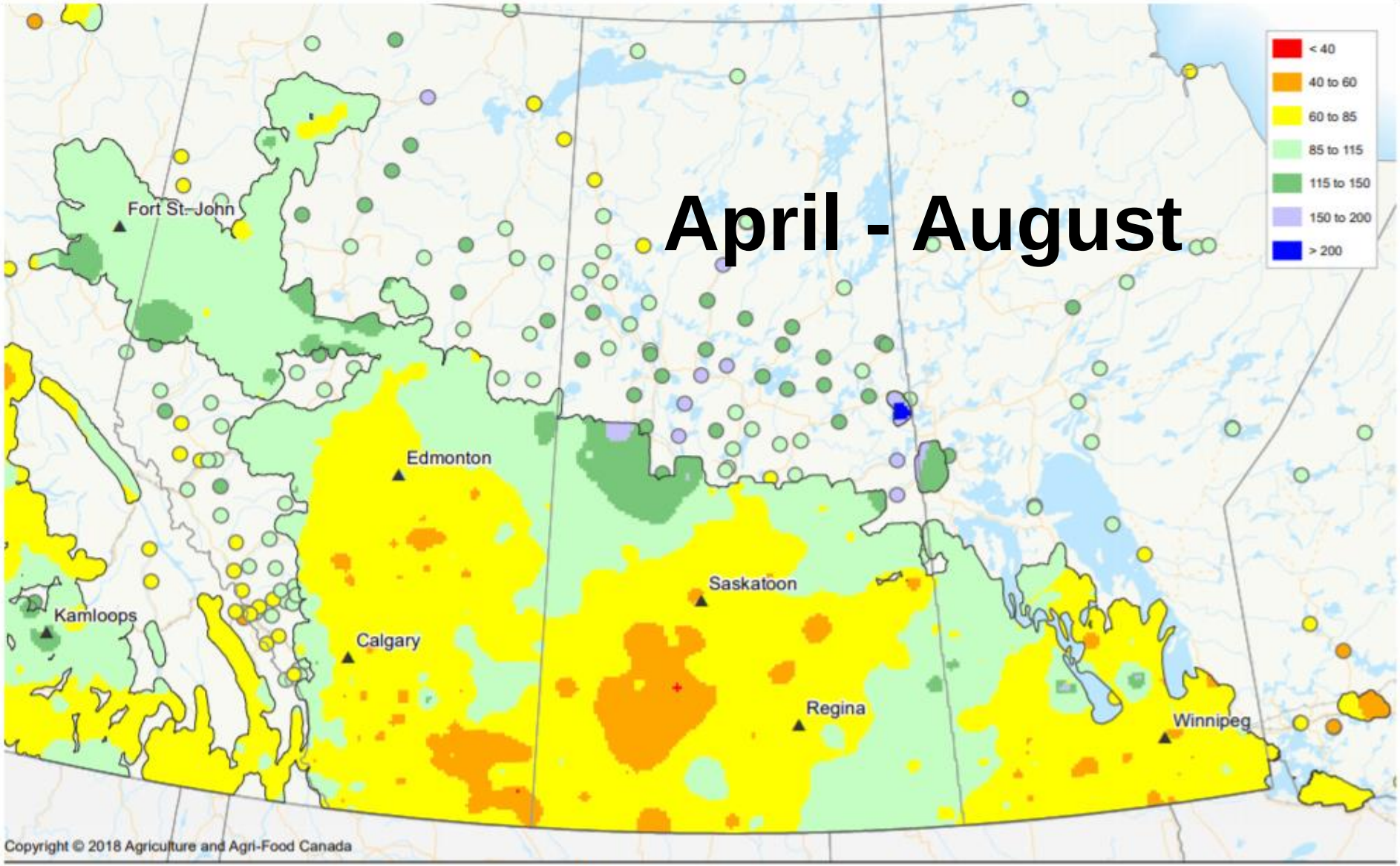
Created: 2018-08-01
www.agr.gc.ca/drought

Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Canada

Percent of Average Precipitation

April 1, 2018 to August 31, 2018



Prepared by Agriculture and Agri-Food Canada's Science and Technology Branch. Data provided through partnership with Environment Canada, Natural Resources Canada, Provincial and private agencies.
Produced using near real-time data that has undergone some quality control. The accuracy of this map varies due to data availability and potential data errors.

Created: 2018-09-04
www.agr.gc.ca/drought

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PRS CROPCASTER®

Total Available Water

Growing Degree Days

HO Spring Wheat
Max Yield: 49.2

Soil Moisture 2
Precipitation 3.5 5.5
Irrigation 0

1535

+/- 10%

Yield: 49.2

Water Storage

Soil Density

Soil pH

Soil EC 1:1

Sandy

70% Clay

VAM

1.3

7.92

0.48

CDA FOOD GRAINS BANK - Common Ground EH 01-03-01 W1

N	19.9	103.3	120.0
P_2O_5	2.8	33.4	35.0
K_2O	28.3	78.7	70.0
S	110.3	12.8	
Ca	521.9	8.9	
Mg	126.2	12.3	
Cu	0.28	0.07	
Zn	0.04	0.25	0.450
Mn	0.50	0.30	
Fe	0.87	0.25	
B	0.19	0.03	

Field Map

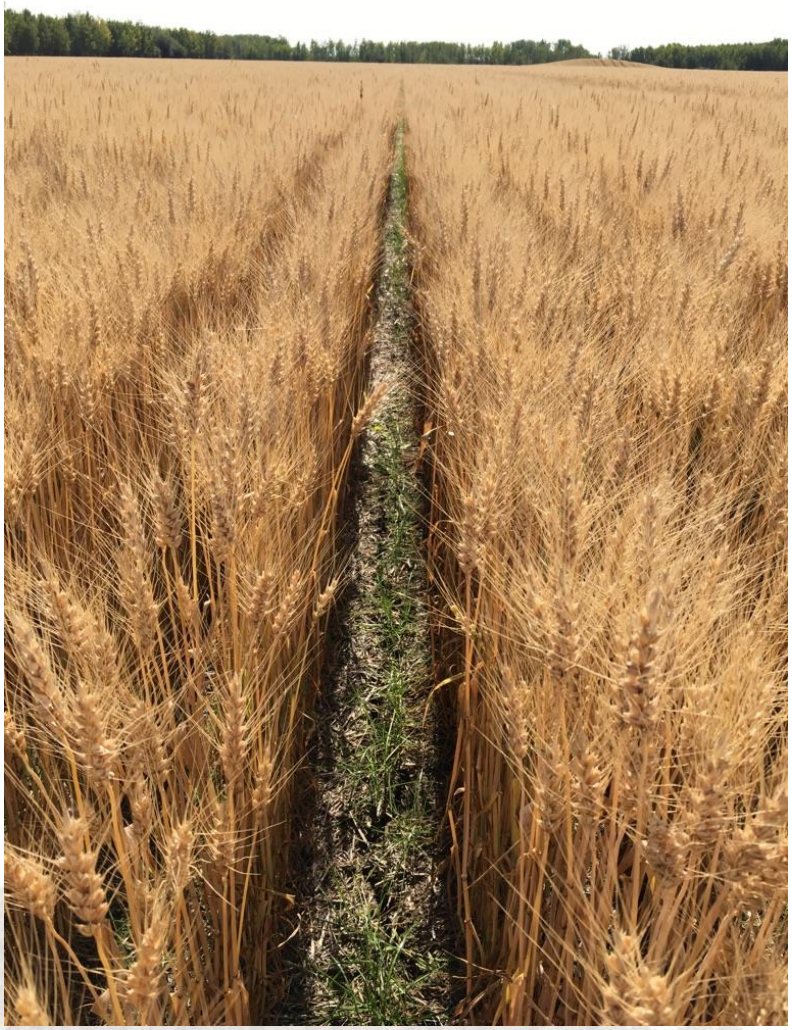
Summary

2018 Common Ground Growing Project Agronomy Comparison

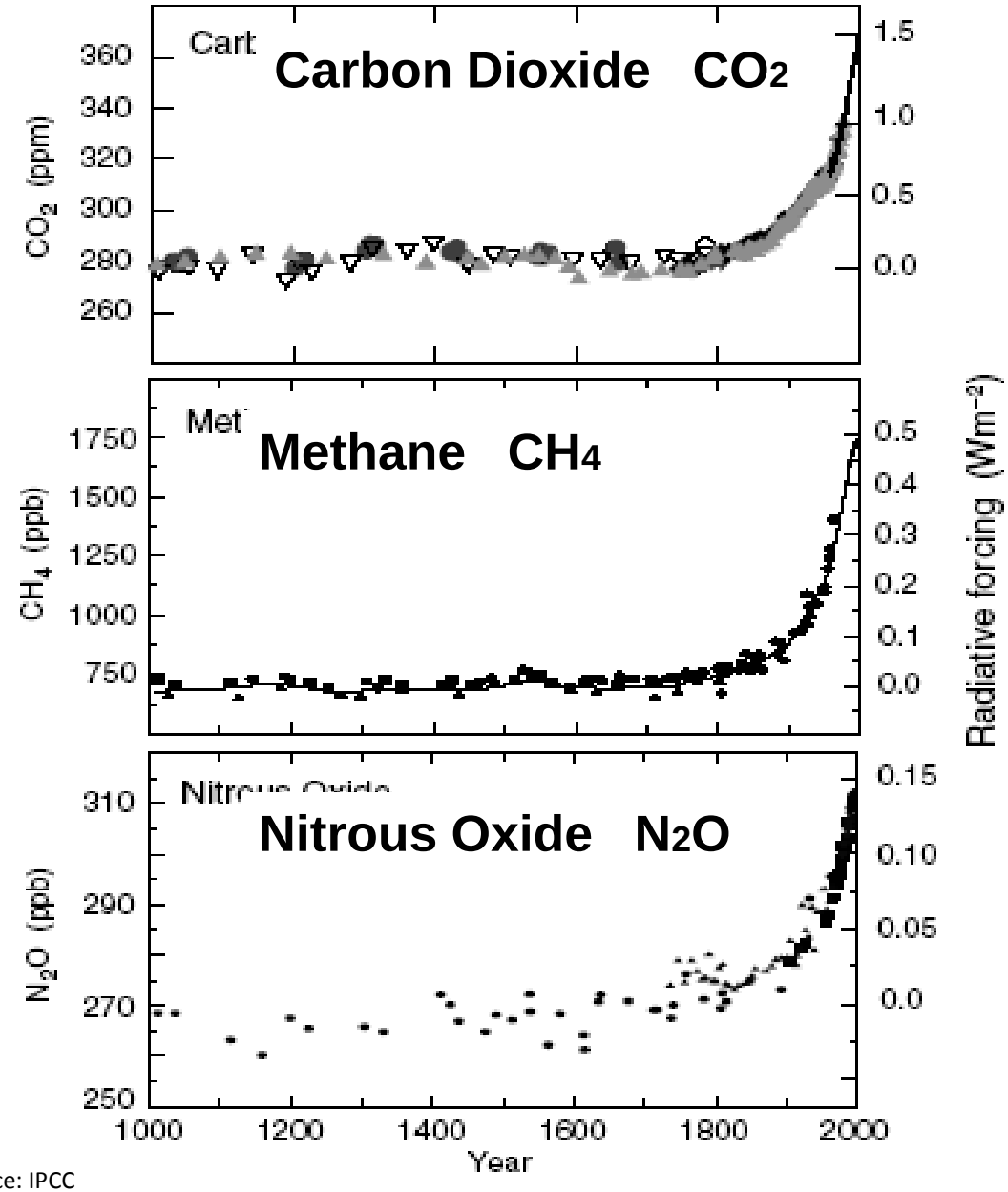
	Farm Blend, 120-35-10-0	WAPA Blend - Low N, 100-35-40-0-2	WAPA Blend - High N, 120-35-40-0-2
Rep.	Plot Yield (Bu/ac)		
1	45.2	49.0	45.6
2	43.3	48.7	40.2
3	46.4	42.2	45.7
4	46.4	42.0	42.6
5	47.7	41.9	45.0
6	51.8	43.5	46.8
Ave	**46.8**	**44.6**	**44.3**
Seeding Rate	**120 lb/ac**	**160 lb/ac**	**160/ac**

What is driving these “good” yields?

- Varieties improved
- Crop care improved
  - Earlier seeding
  - Improved weed control
  - Improved disease control
- Other factors?



Global Greenhouse Gas Trends



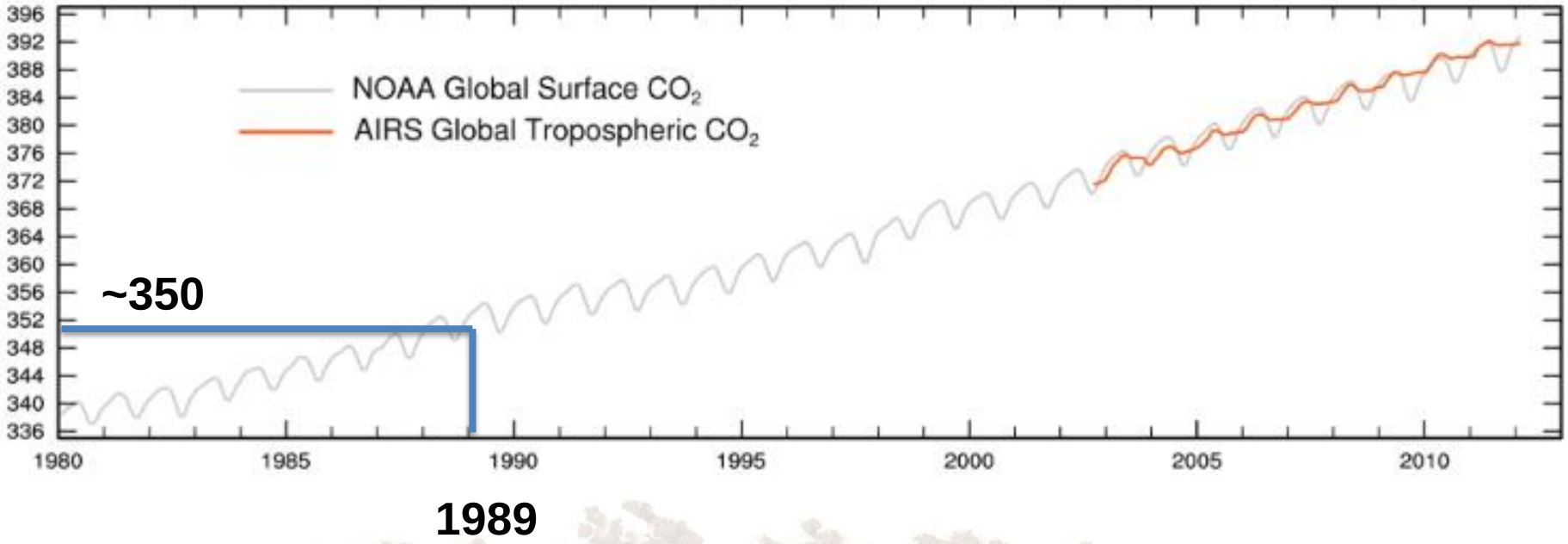
Source: IPCC

Source: Emission Database for Global Atmospheric Research Ver. 3.2, Fast Track 2000 project

Recent Monthly Average Mauna Loa CO_2

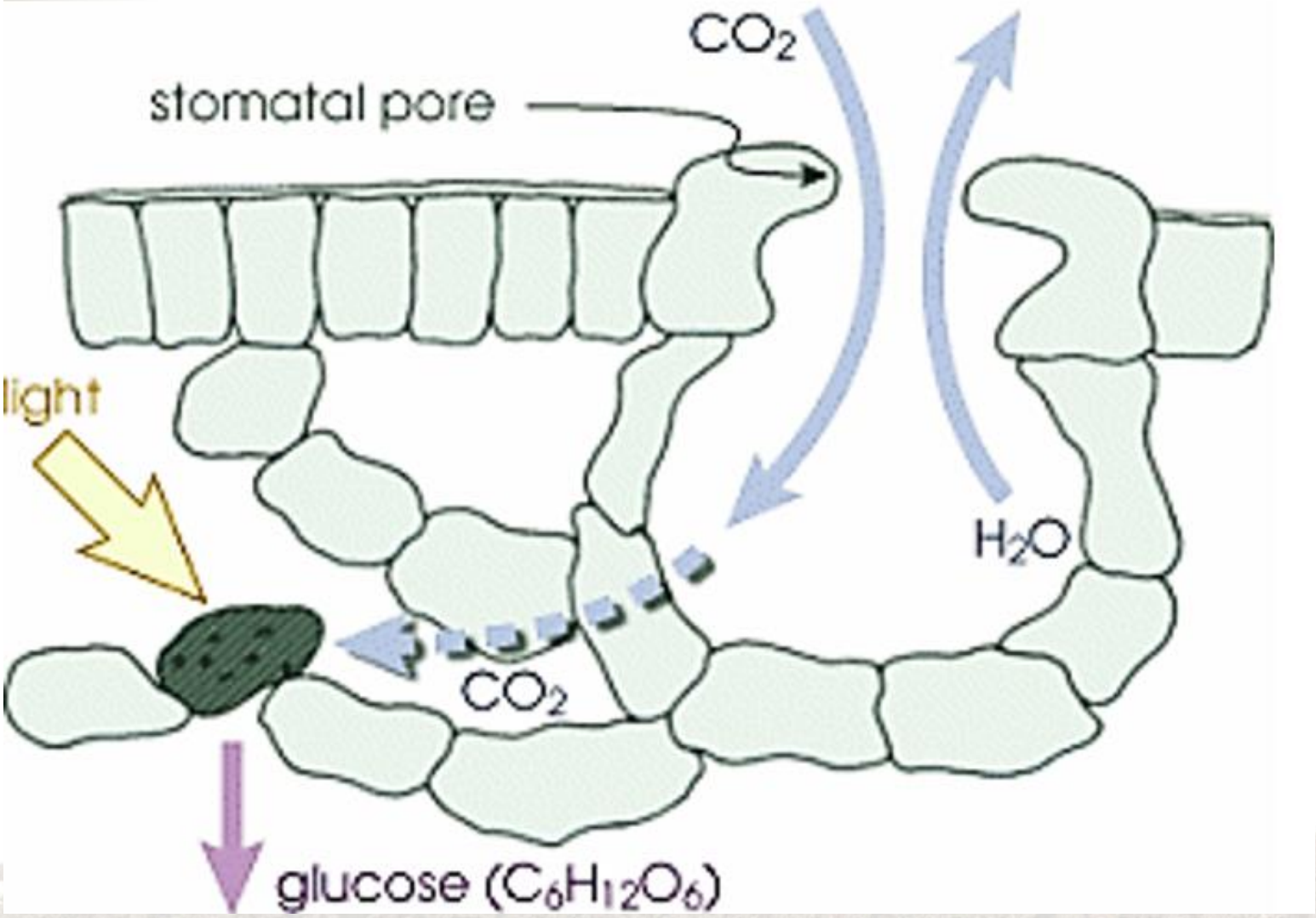
January 2019: 410.83 ppm
January 2018: 407.96 ppm
Last updated: February 5, 2019

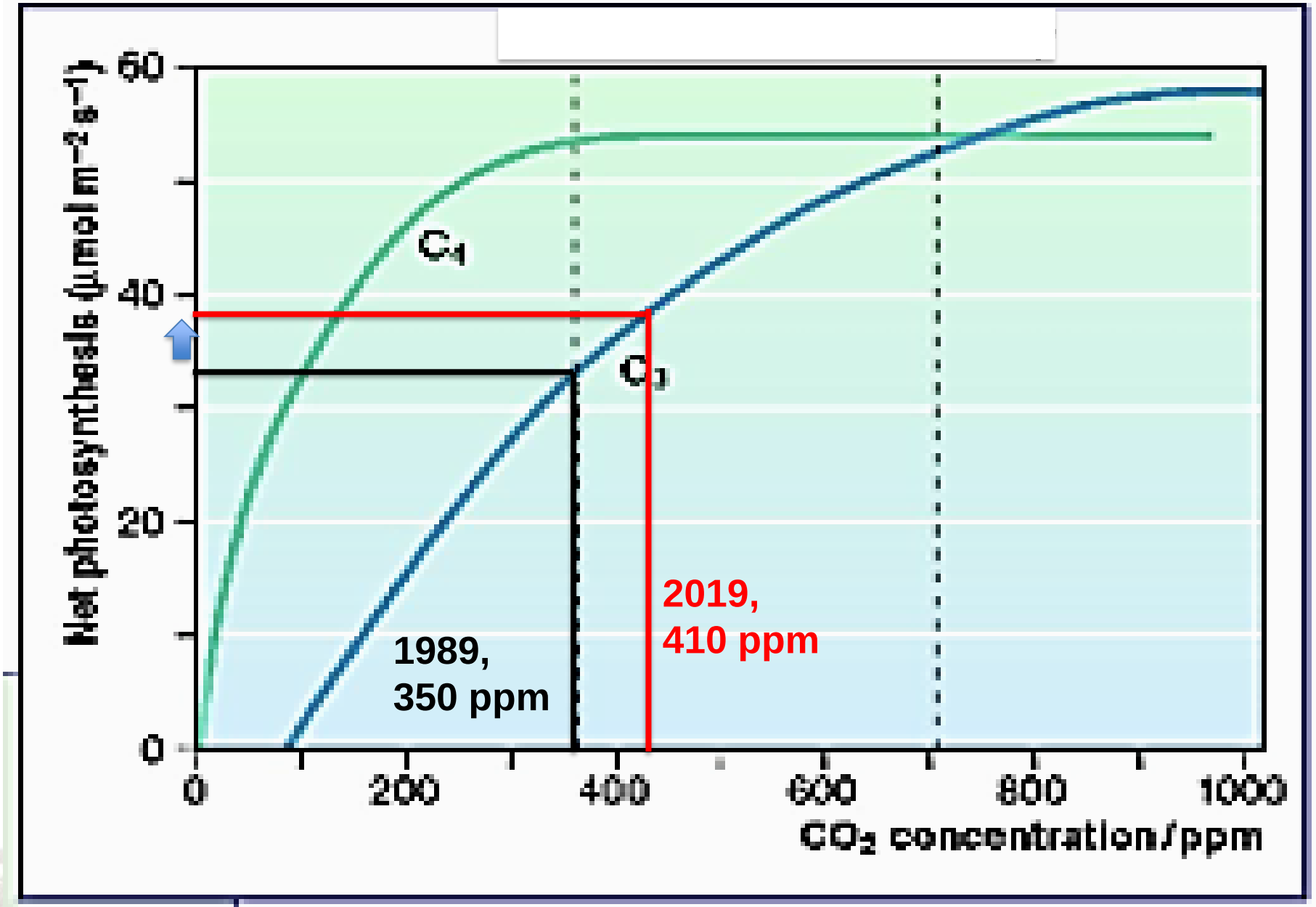
Source:
https://www.esrl.noaa.gov/gmd/ccgg/trends/



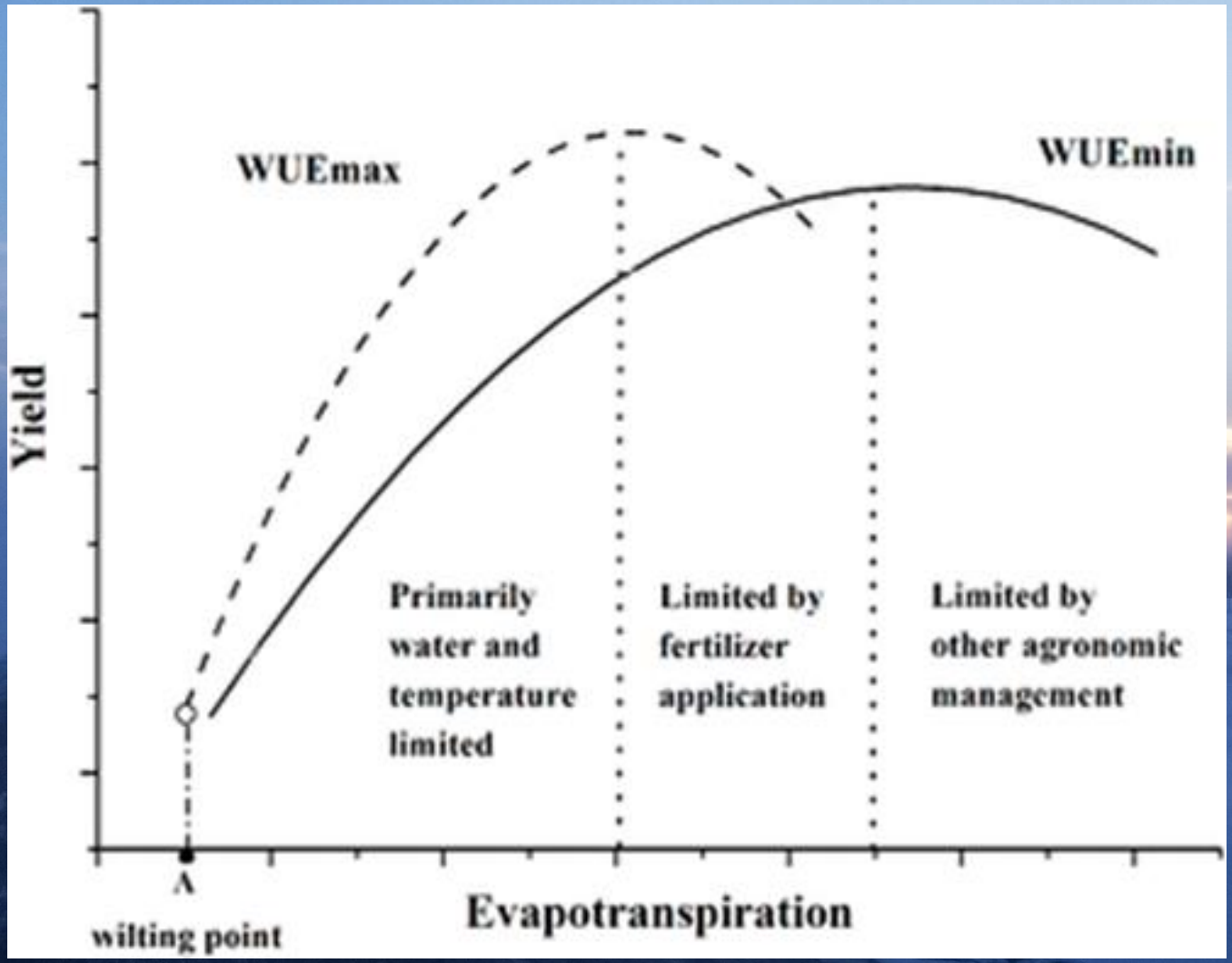
https://upload.wikimedia.org/wikipedia/commons/5/5f/AIRS_Carbon_Dioxide_Vertical.png

The Great Compromise

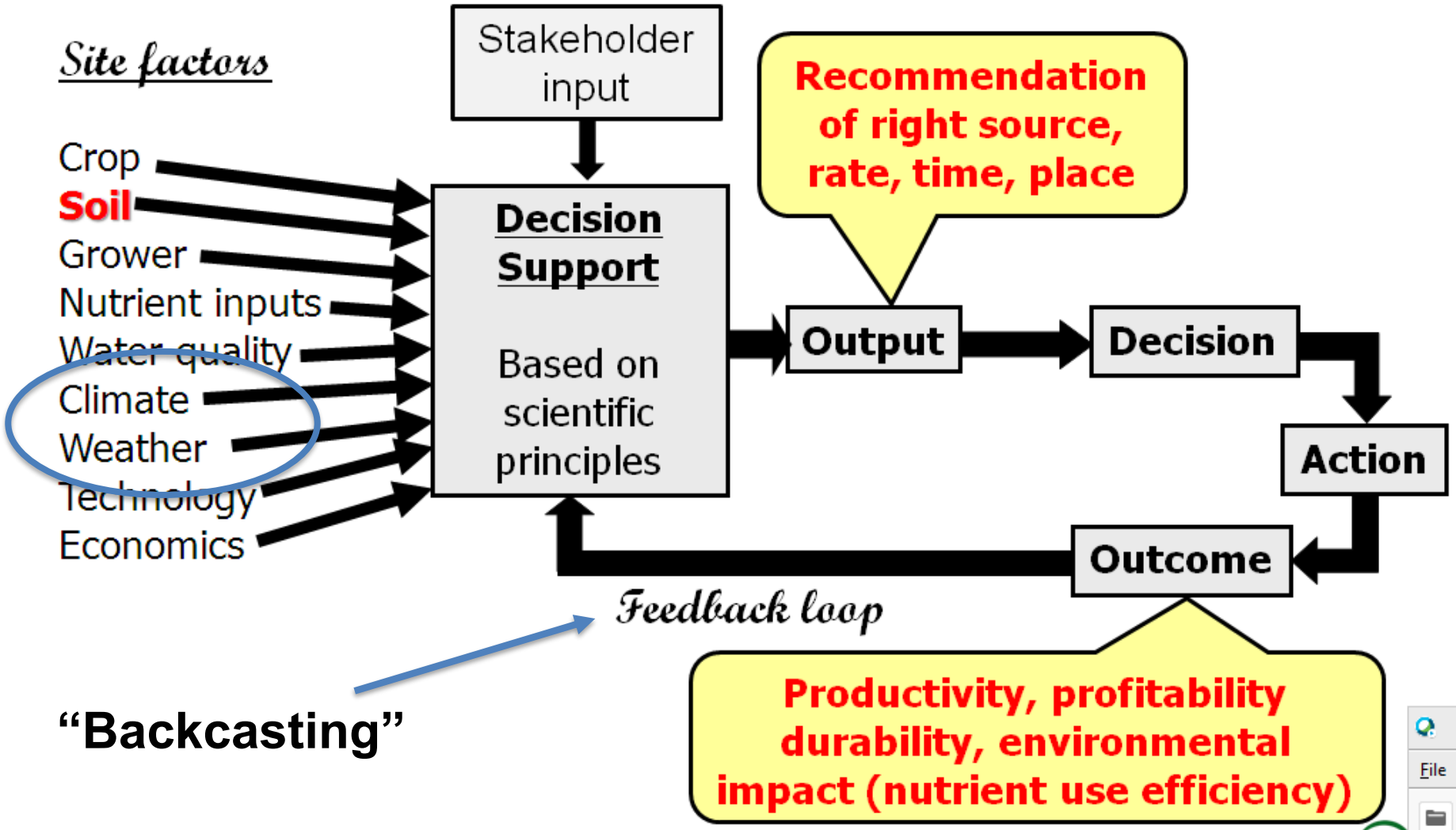



Net photosynthesis (μmol m⁻² s⁻¹)
60
40
20
0
0
200
400
600
800
1000
CO₂ concentration/ppm
C₄
C₃
1989,
350 ppm
2019,
410 ppm

What is the Potential Impact on Wheat Yields?



Can soil testing be better integrated into adaptive management decision support systems?



"Backcasting"

After Fixen, 2007.

“The Plan…”

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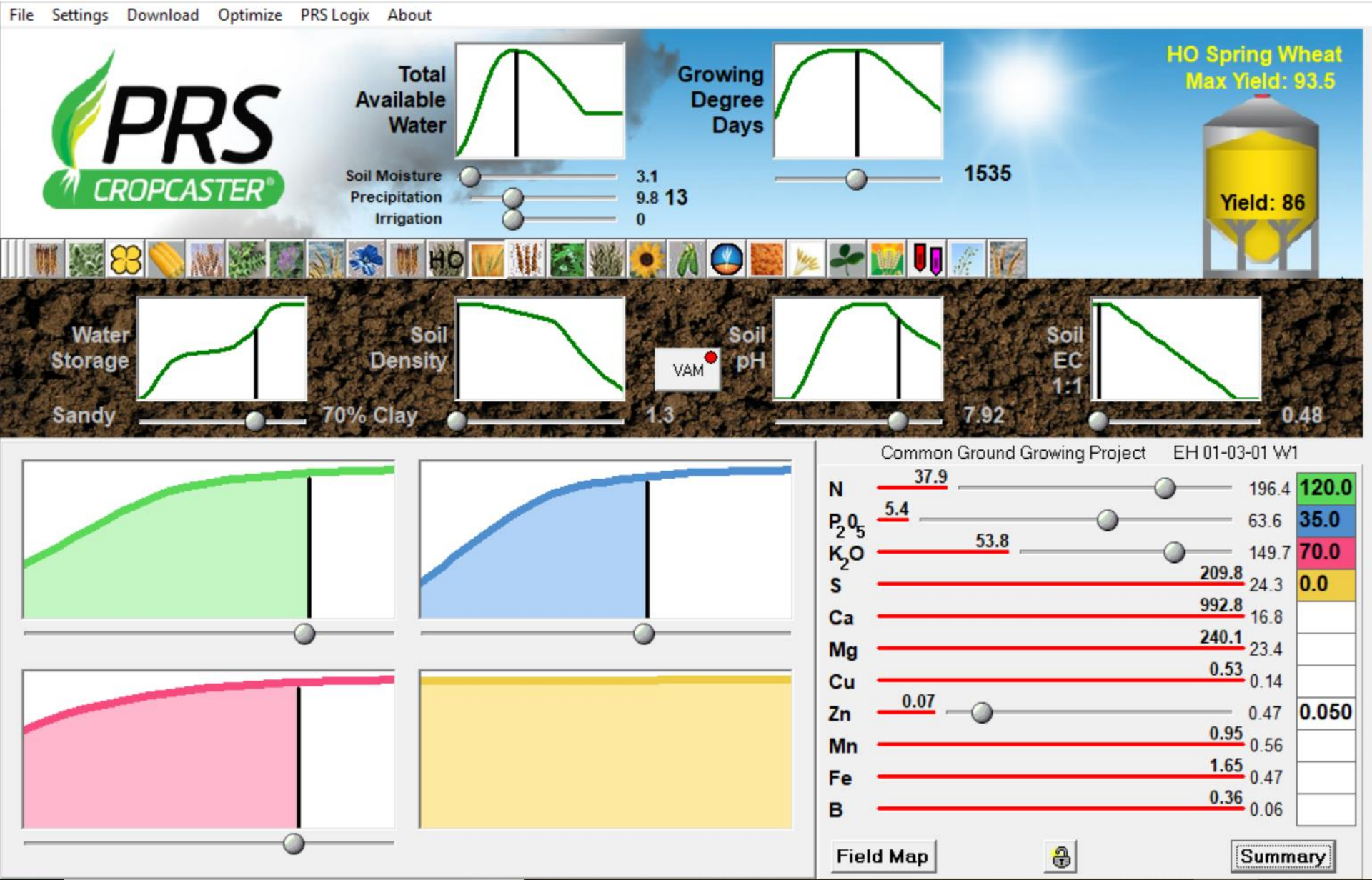

“The Reality…”

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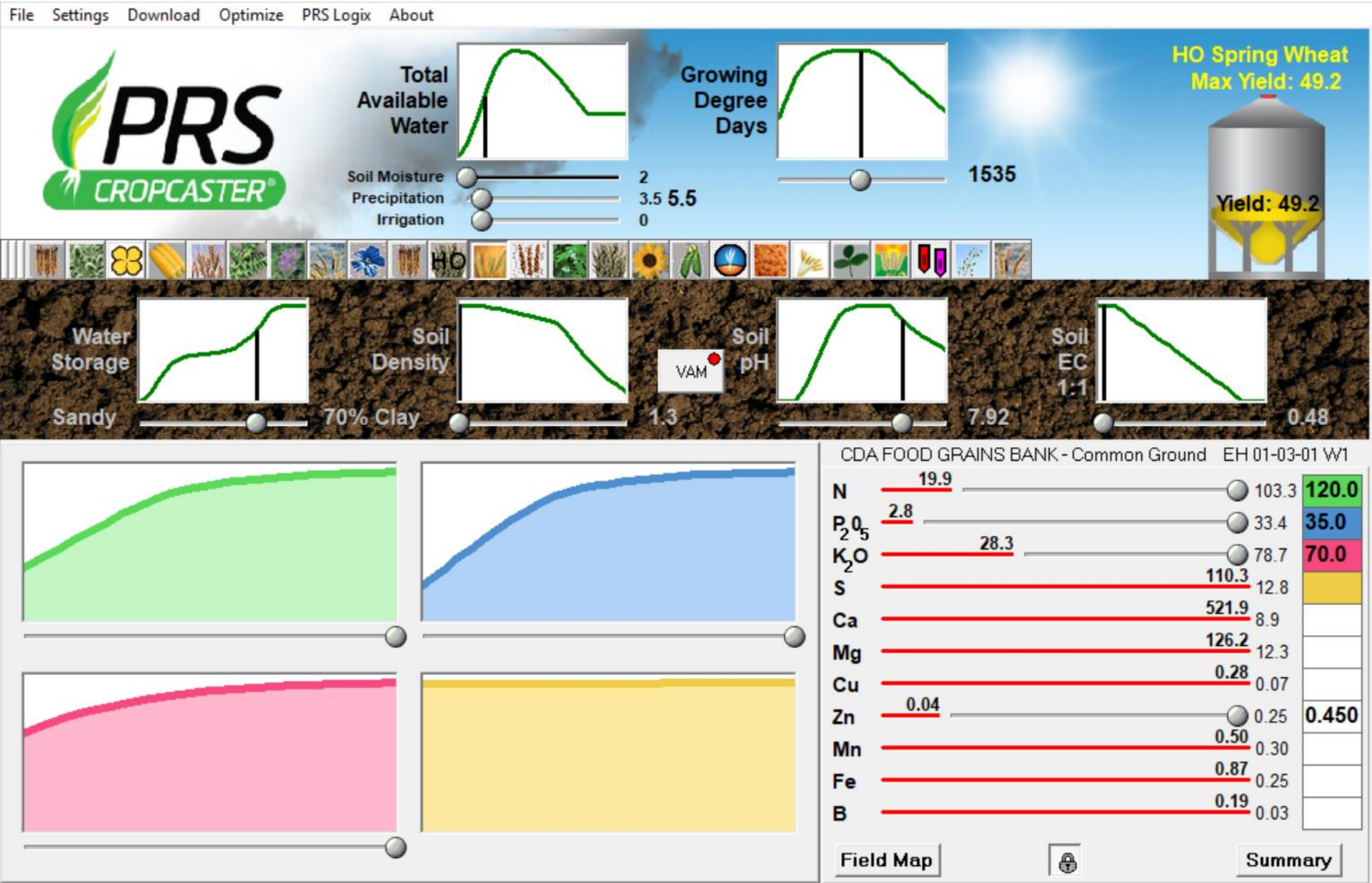

In summary

- Soil nutrient supply rates have settled down after 2016 (very wet), 2017 (very dry).
- 2018 crops were pretty good despite dry growing season conditions.
- Atmosphere is changing; hypothesis being tested around concept of CO_2 Fertilization.
- Can quickly update fertilizer agronomy to changing environment using “backcasting” process in simulation models.

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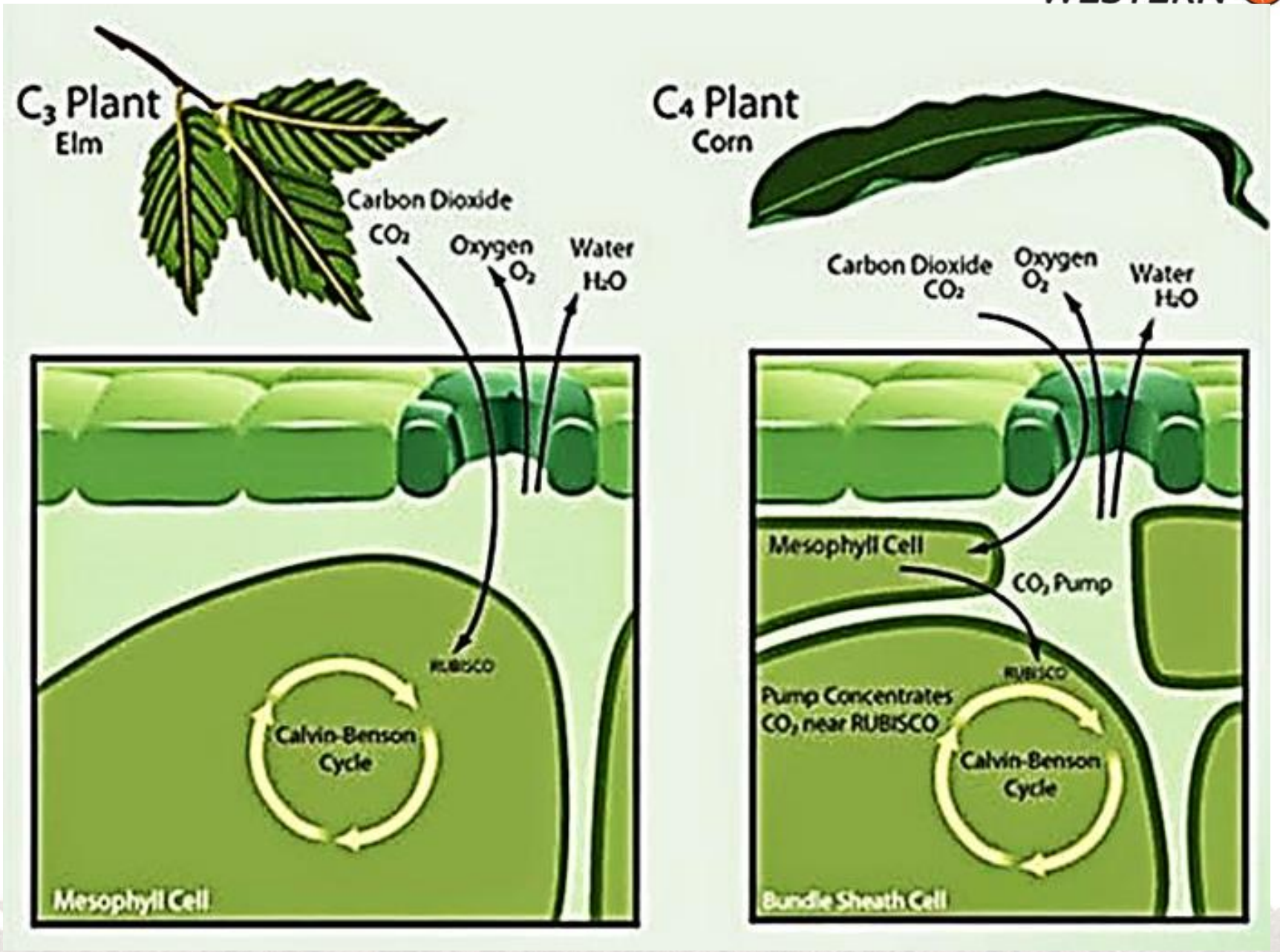
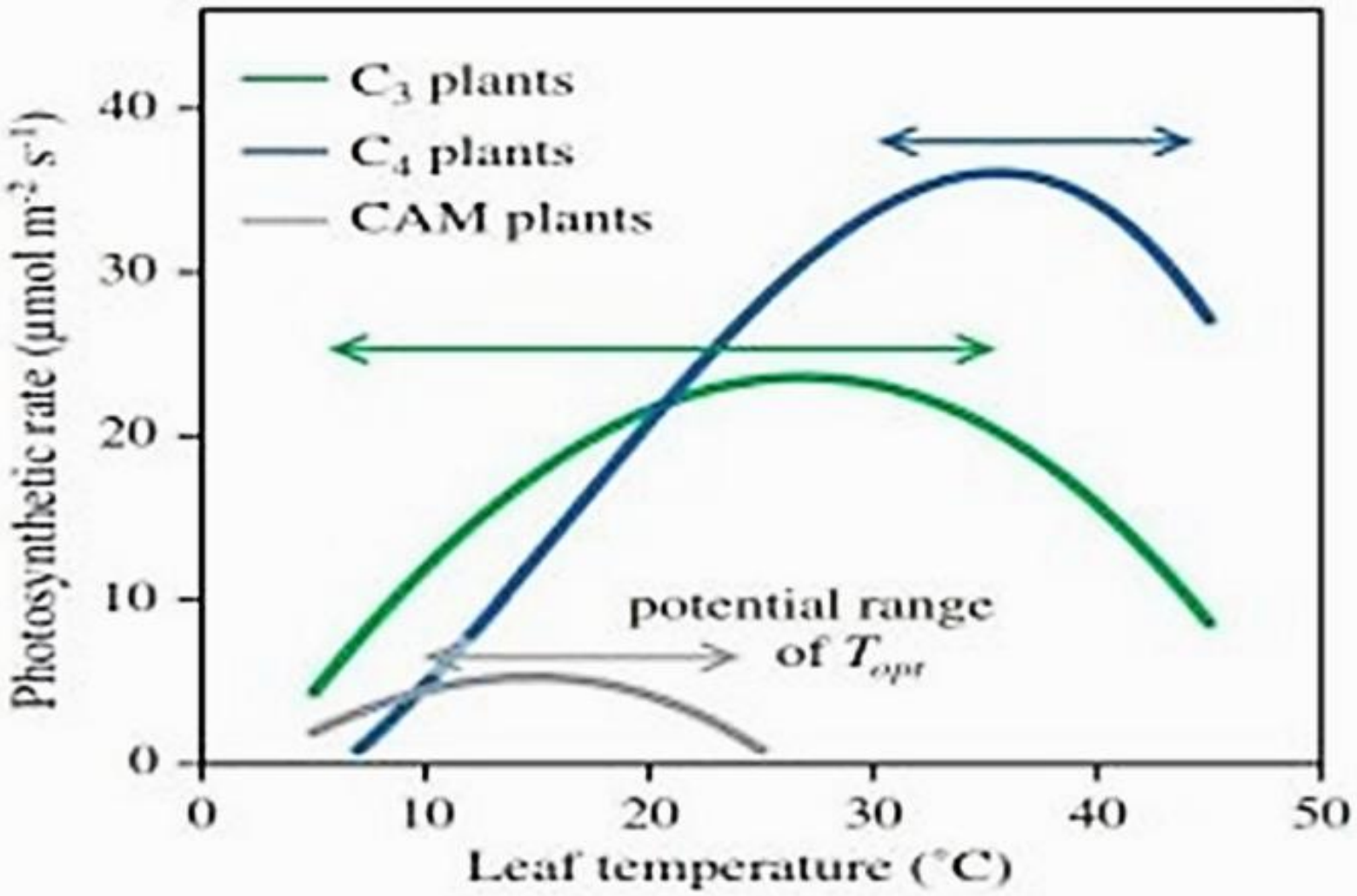
Discussion?

Contacting Western Ag:


C3 Plant
Elm
Carbon Dioxide
CO2
Oxygen
O2
Water
H2O
RUBISCO
Calvin-Benson
Cycle
Mesophyll Cell
C4 Plant
Corn
Carbon Dioxide
CO2
Oxygen
O2
Water
H2O
Mesophyll Cell
CO2 Pump
RUBISCO
Pump Concentrates
CO2 near RUBISCO
Calvin-Benson
Cycle
Bundle Sheath Cell

Thank you

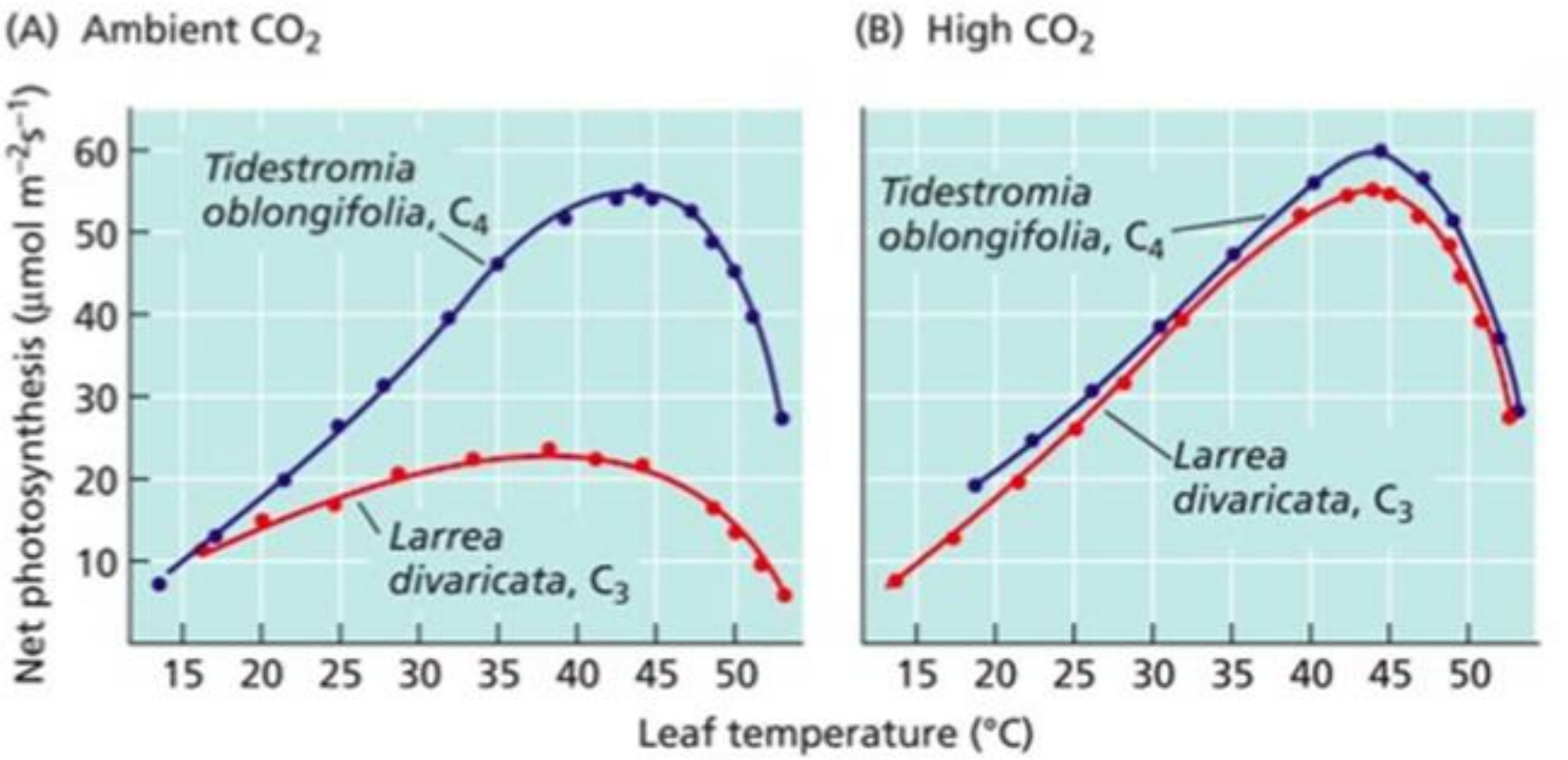
westernag.ca



Temperature responses of photosynthesis in C_3, C_4, CAM plants

Source: Plant ,Cell and Environment 2006. 29, 315-330.

Arizona Honeysweet (C4) vs Chaparral (C3)



What is the Potential Impact on Wheat Yields?

Some factors:

- Drought
- Heat stress
- Flooding
- Frost
- Hail
- Weeds, disease, insects
- Nutrition
- Wheat yield components, quality