Sustainable Silage Corn Production, Opportunities and Necessities in NL

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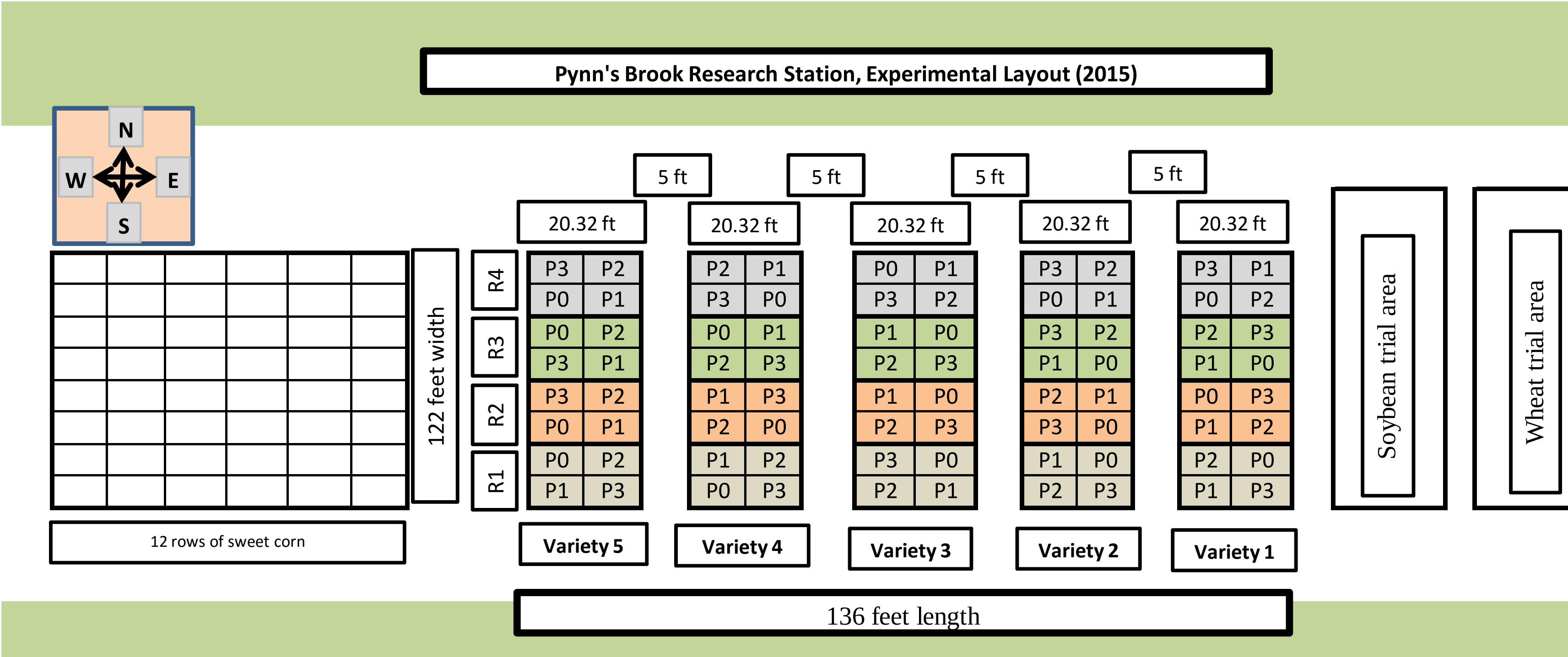
Boreal Ecosystem Research Initiative

GRENFELL CAMPUS
MEMORIAL UNIVERSITY

Sustainable silage corn production with dairy manure application



Variety	Variety Name	CHU	Company	Trait
Variety 1	Fusion RR_2	2200	Brett Young	RR_2
Variety 2	Yukon R	2150	Brett Young	RR_2
Variety 3	A4177G3 RIB	2175	Pride	VT3/RR
Variety 4	DKC-2317 RIB	2075	DEKLAB	
Variety 5	DKC26-28 RIB	2150	DEKLAB	GENVT2P

Phosphorus treatments

P_0	Control P (no P application)		
P_1	High P manure (0.6 kg P_2O_5/1000L)	@ 40 L $plot^{-1}$	30000 Lha^{-1}
P_2	Low P manure (0.3 kg P_2O_5/1000L)	@ 40 L $plot^{-1}$	30000 Lha-1
P_3	Inorganic P (0-45-0) @ 110 Kg ha^{-1}		

Parameters/Measurements

Leaf area and leaf chlorophyll contents LI-3000C, and SPAD 502 plus Chlorophyll Meter
In-situ root morphology with root scanner (CI 600)
Gas exchange rates/photosynthesis with LI-6400XT
Plant and soil sampling (P-uptake, root-shoot ratio, dry matter accumulation, soil sampling for root exudates)
Greenhouse gas emission (Chambers)
Biomass and plant height at final harvest
Determining crude protein, acid detergent fiber (ADF), neutral detergent fiber (NDF), non-structural carbohydrates (NSC), total digestible nutrients (TDN), and ash content with FT-NIR

Experiment details

Seeding date	June 4, 2015
Seed rate	89980 seeds ha^{-1}
Plot size	3m×4.40m
Plot separation	June 28, 2015
N application (kg ha^{-1})	90.72
P application (kg ha^{-1})	90.72
Weed control	Glyphosate
Harvest date	Oct. 16, 2015
Experiment Design	RCBD factorial

Silage Corn Seeding at Pynn's Brook Research Station


GANDY
05135

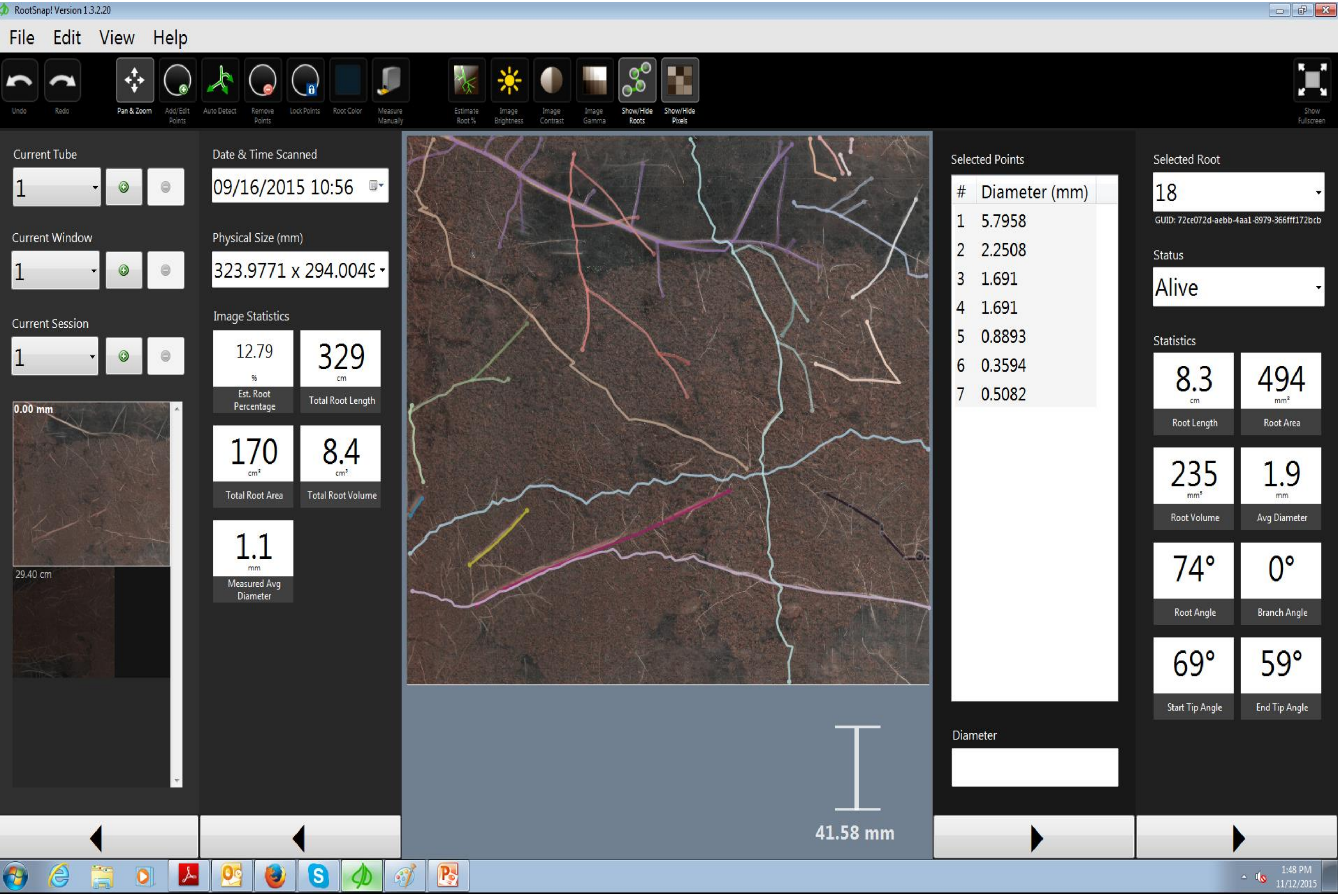
Manure application

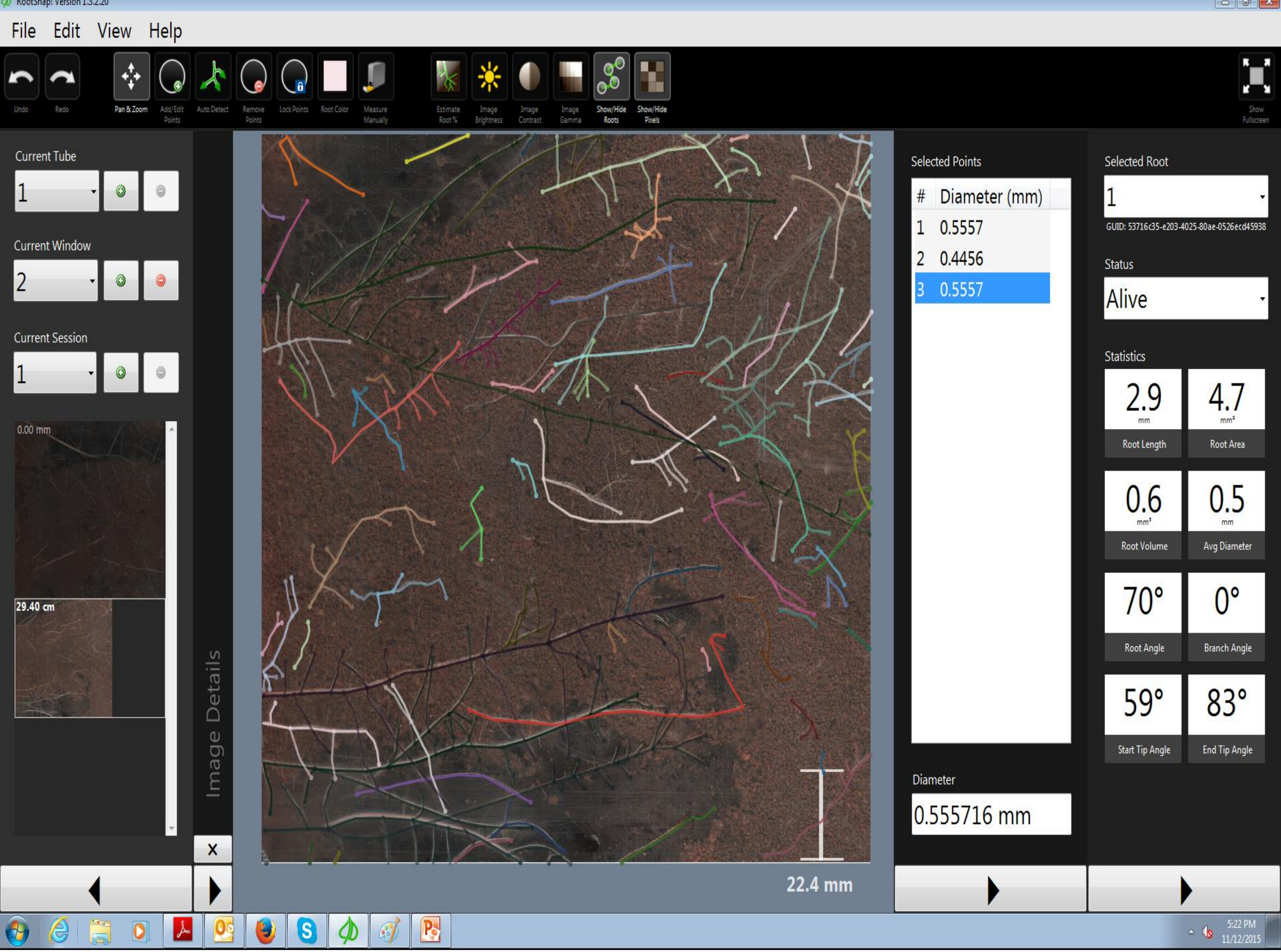
Installation of acrylic tubes

Installation of acrylic tubes

High resolution root scanning with CI-600

Mapping roots with Rootsnap (CI-690)





RootSnap! Version 1.3.2.20
File
Edit
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Help
Undo
Redo
Pan & Zoom
Add/Edit Points
Auto Detect
Remove Points
Lock Points
Root Color
Measure Manually
Estimate Root %
Image Brightness
Image Contrast
Image Gamma
Show/Hide Roots
Show/Hide Pixels
Show Fullscreen
Current Tube
1
Current Window
2
Current Session
1
0.00 mm
29.40 cm
Image Details
22.4 mm
Selected Points
Diameter (mm)
1 0.5557
2 0.4456
3 0.5557
Diameter
0.555716 mm
Selected Root
1
GUID: 53716c35-e203-4025-80ae-0526ecd45938
Status
Alive
Statistics
2.9 mm Root Length
4.7 mm² Root Area
0.6 mm³ Root Volume
0.5 mm Avg Diameter
70° Root Angle
0° Branch Angle
59° Start Tip Angle
83° End Tip Angle
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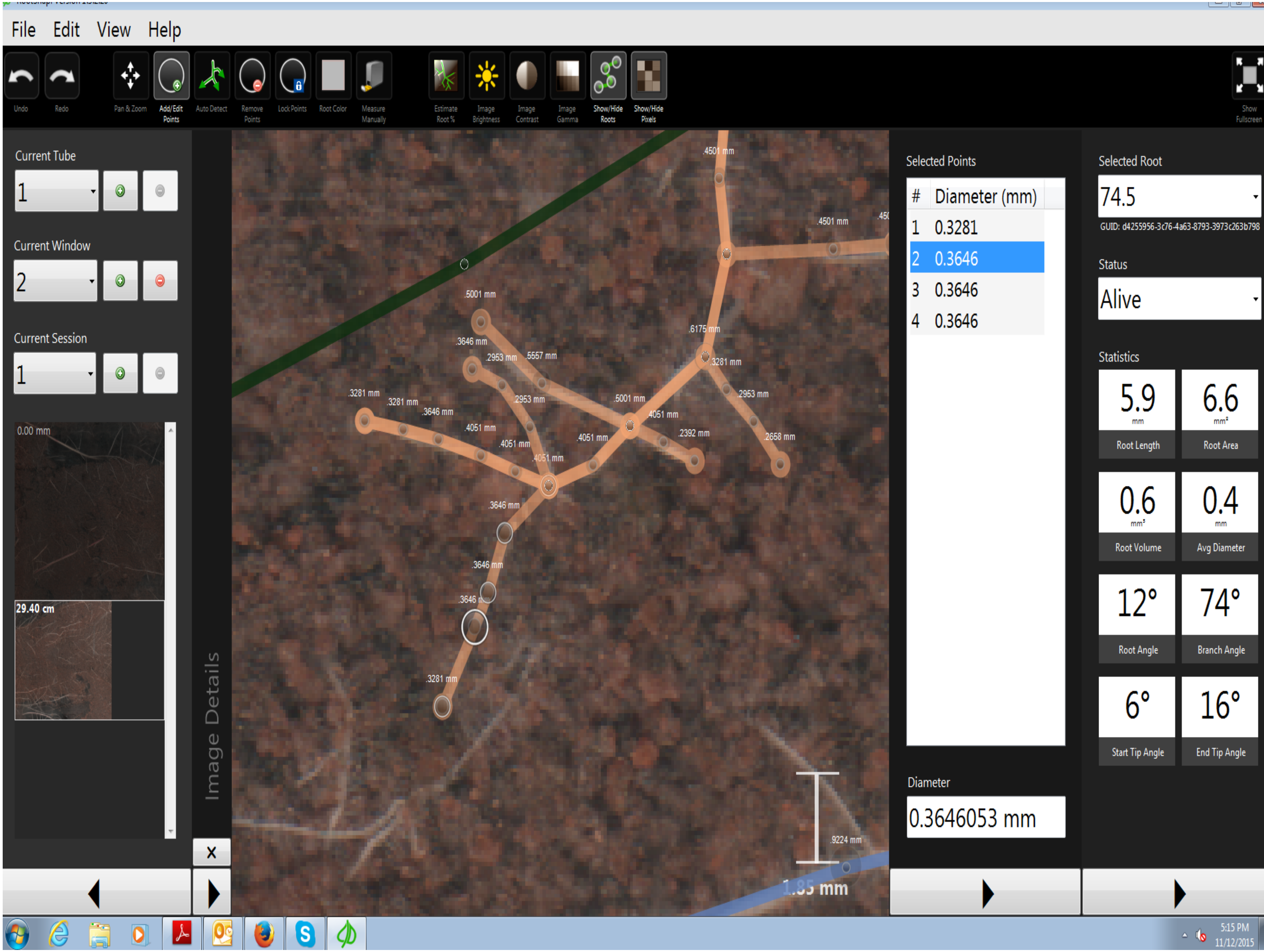
11/12/2015



File
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Add/Edit Points
Auto Detect
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Image Brightness
Image Contrast
Image Gamma
Show/Hide Roots
Show/Hide Pixels
Show Fullscreen
Current Tube
1
Current Window
2
Current Session
1
0.00 mm
29.40 cm
Image Details
X
Selected Points
Diameter (mm)
1 0.3281
2 0.3646
3 0.3646
4 0.3646
Diameter
0.3646053 mm
Selected Root
74.5
GUID: d4255956-3c76-4a63-8793-3973c263b798
Status
Alive
Statistics
5.9 mm Root Length
6.6 mm² Root Area
0.6 mm³ Root Volume
0.4 mm Avg Diameter
12° Root Angle
74° Branch Angle
6° Start Tip Angle
16° End Tip Angle
1.85 mm
.9224 mm
5:15 PM
11/12/2015

Leaf area and chlorophyll measurements

Greenhouse gas sampling

Sustainable Farming Community through sustainable silage corn following dairy manure

Why manure as phosphorus source?

-Food scarcity

-Water scarcity

-Why NOT debate on global phosphorus security?

BECAUSE!

Manure is a renewable resource

Newfoundland Labrador

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MANURE ANALYTICAL REPORT

Submitted by: Name: Dr Mumtaz Cheema
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Date Received: 2014-10-02
Date Reported: 2014-10-20

Lab #: MC36 **Sample ID: Oct 1st - # 2** **Type of Manure: liquid dairy**

Analysis Results (as received basis)	
Dry Matter (%)	9.6
pH	7.0
Total Nitrogen (%)	0.328
Total Phosphorous (%)	0.057
Total Potassium (%)	0.328
Total Calcium (%)	0.169
Total Magnesium (%)	0.065
Total Iron (ppm)	58
Total Manganese (ppm)	24
Total Copper (ppm)	4.3
Total Zinc (ppm)	16
Total Boron (ppm)	3
Total Sodium (ppm)	665
Soluble Salts (mS/cm)	

Nutrients Equivalency	kg/tonne	kg/1000 L
Nitrogen (N)		1.1
Phosphate (P_2O_5)		0.6
Potash (K_2O)		3.6

Note: 1 kg/tonne = 2 pounds/ton
1 kg/1000 L = 10 pounds/1000 gallons

Interpretation:
Ten (10) thousand litres of the manure would supply 11 kg N, 6 kg P_2O_5 and 36 kg K_2O for the 1st year crop. Deduct fertilizer application rate accordingly.

Application Time	Incorporation
☐ Late Summer	☐ Injected
☒ Early Fall	☐ Incorporated (<24 hours)
☐ Late Fall/Winter	☒ Incorporated within 3 days
☐ Spring	☐ Incorporated within 5 days
☐ Summer	☐ Not incorporated

Tom Fagner
Soil & Feed Laboratory

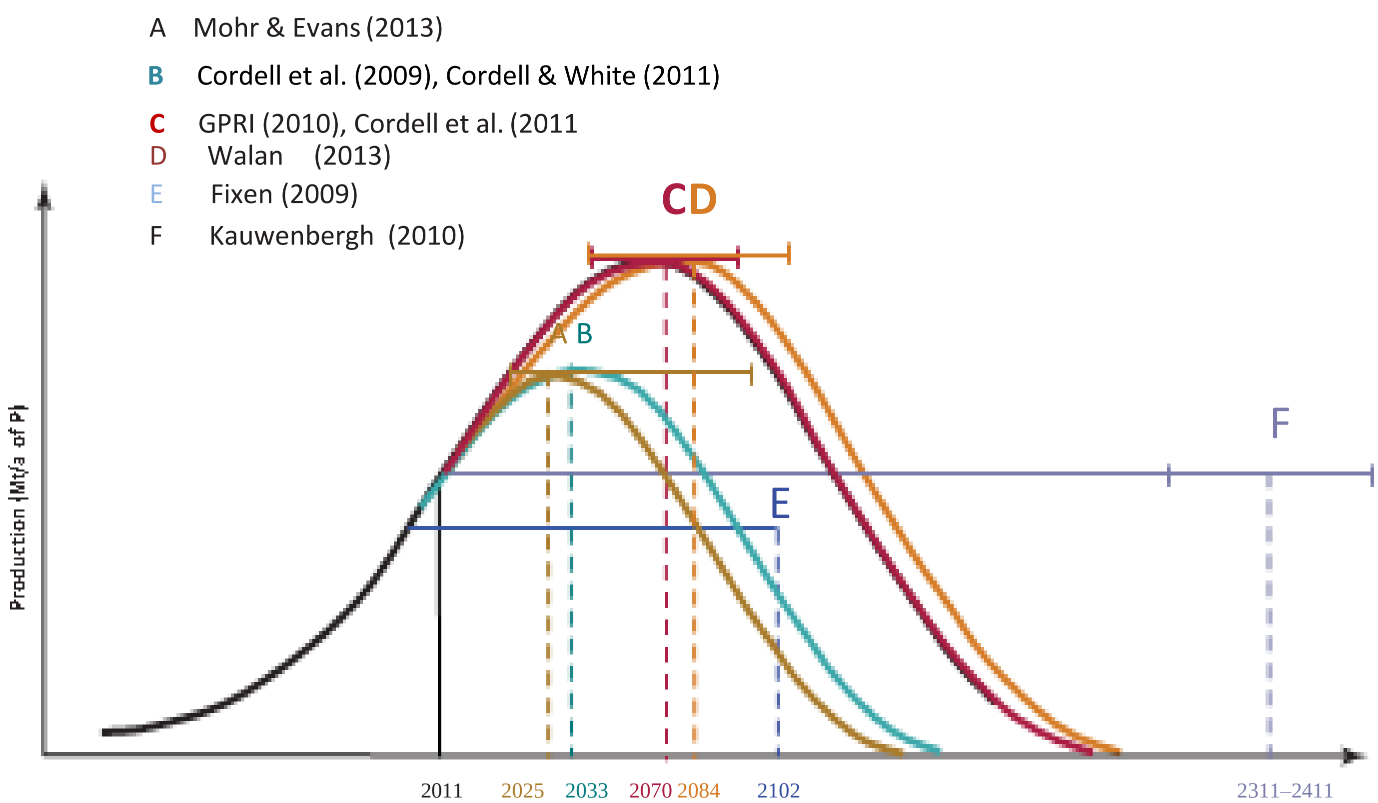
Reviewed by: Y. Jiao

For further information on manure nutrient availability and manure nutrient management, contact Soil Fertility Specialist at 709-637-2685

Phosphorus is very much important

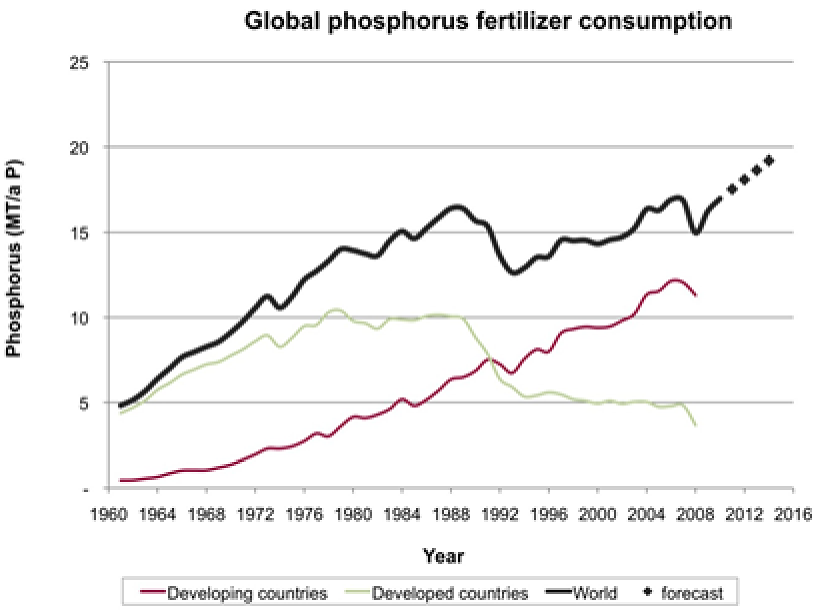
Phosphorus (P) is vital to plant growth and is found in every living plant cell. It is involved in several key plant functions, including energy transfer, photosynthesis, transformation of sugars and starches, nutrient movement within the plant and transfer of genetic characteristics (DNA, RNA) from one generation to the next

- Stimulated root development
- Increased stalk and stem strength
- Improved flower formation and seed production
- More uniform and earlier crop maturity
- Increased nitrogen N-fixing capacity of legumes
- Improvements in crop quality
- Increased resistance to plant diseases.

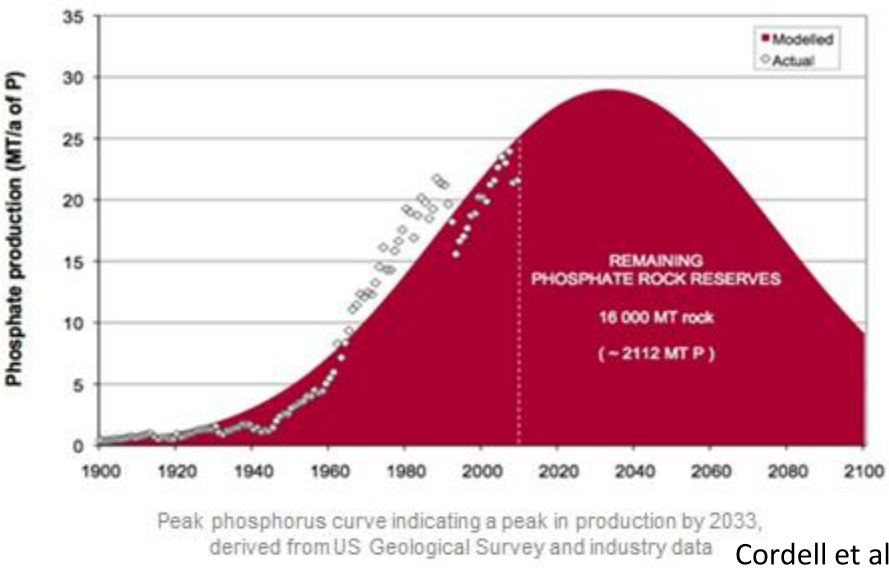


Global phosphate depletion scenarios by different authors, indicating different depletion or peak years based on different assumptions[Studies depicted are Mohr & Evans 2013; Cordell et al. and Cordell & White 2011; GPRI 2010, Cordell et al. 2011; Walan 2013; Fixen 2009; Kauwenbergh 2010]

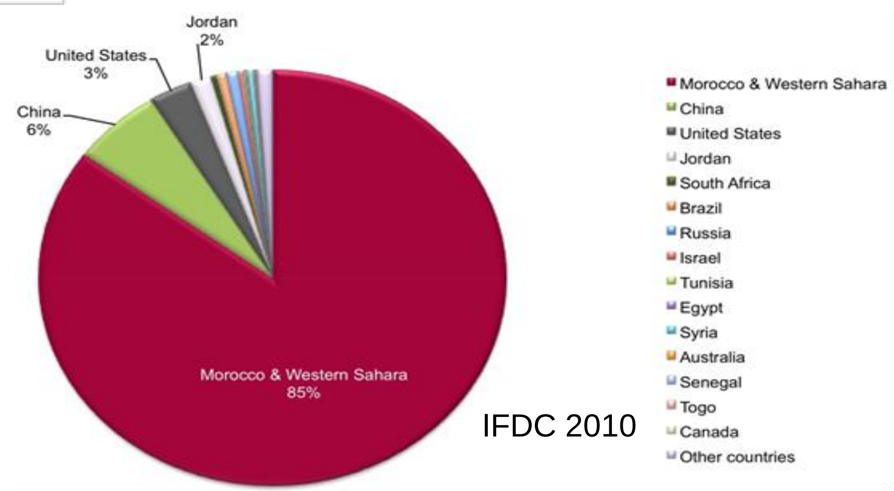
Global P consumption and reserves



IFA, 2008

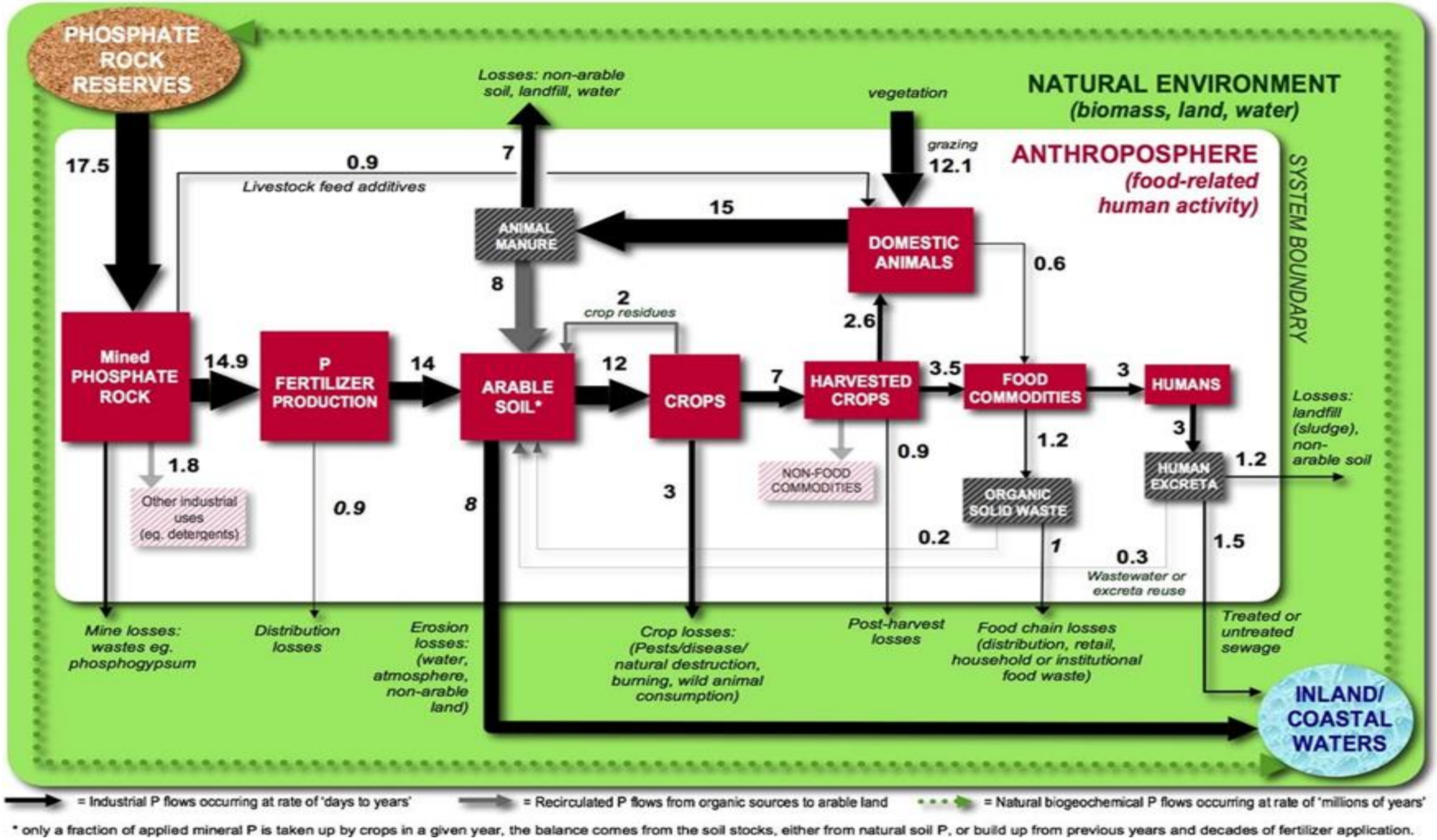


Cordell et al. 2009



IFDC 2010

Key phosphorus flows through the global food production and consumption system, indicating phosphorus usage, losses and recovery at each key stage of the process. Units are in Million tons/year.



IFA, 2006

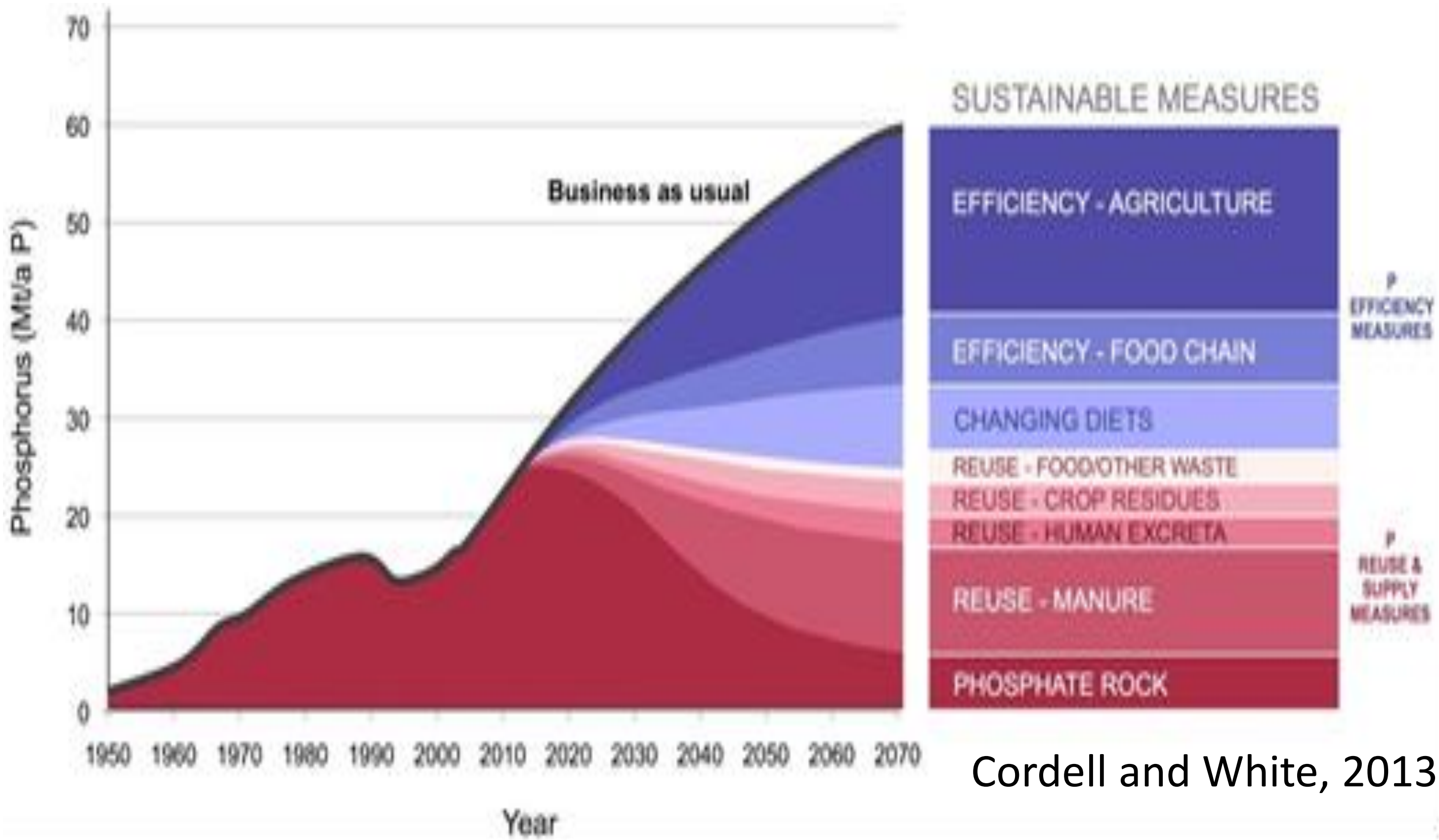
What are the key options?

To reduce the significant losses occur throughout the system—from mining to field to fork, (mining five times the amount of phosphorus that humans are actually consuming in food)

Alternative renewable phosphorus sources,

- manure (around 15 MT P),
- human excreta (3 MT P) and
- food residues (1.2 MT P),

A preferred scenario for meeting long-term global phosphorus demand: integrated demand management (efficiency) measures (blue) and supply-side (reuse) measures (red).



Cordell and White, 2013

THANKS

Research Team

Dr. Nadeem (Post-doc)
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Dr. Galagedara (Hydrology and Water Resources-BERI)
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Dr. Kavanagh (Scientist-Forestry & Agrifoods Agency)

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