# Crop Nutrient Issues

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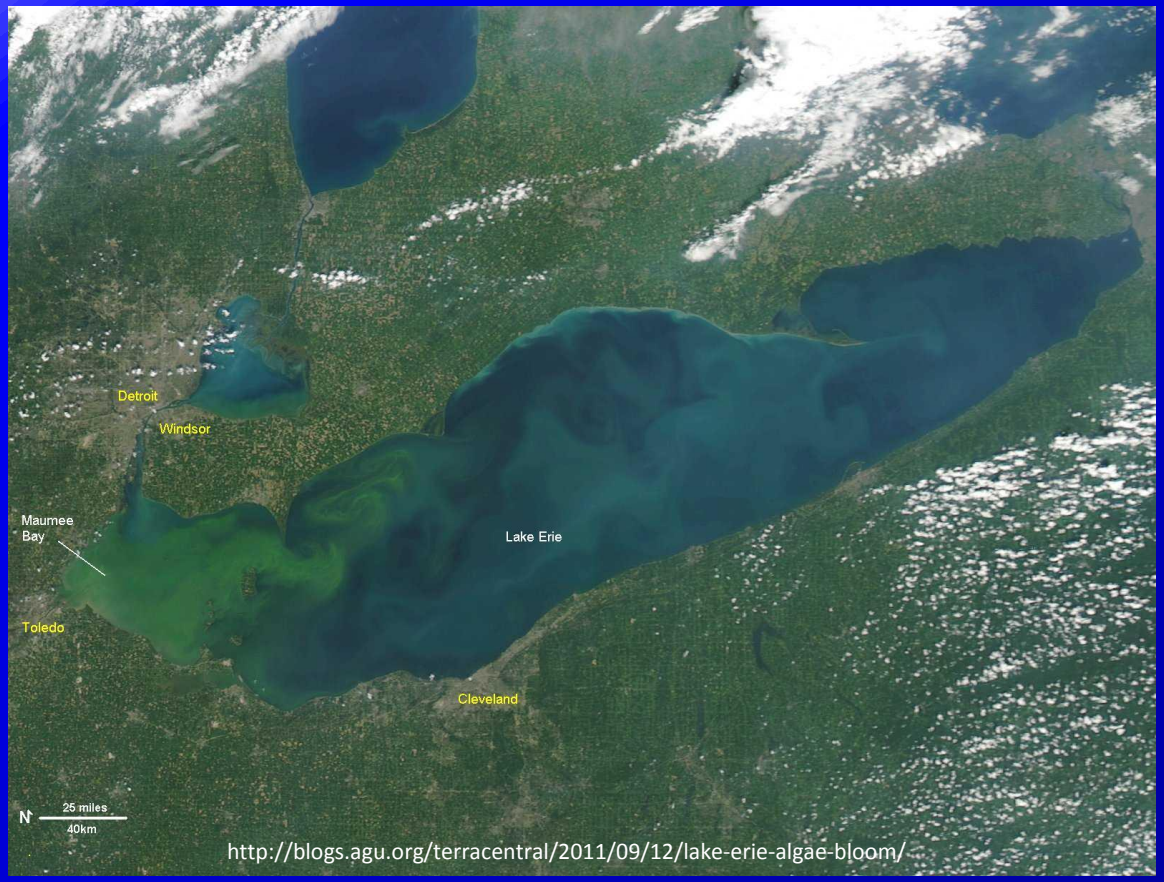
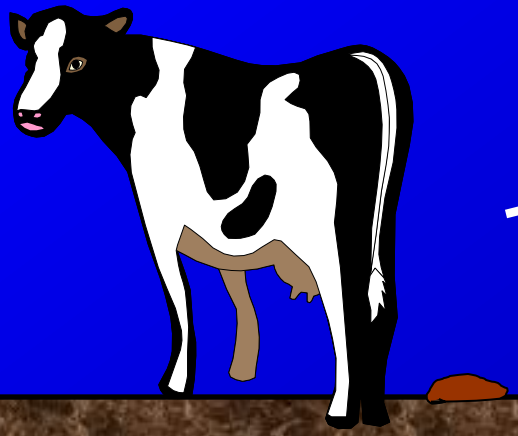
# Phosphorus Loading




http://blogs.agu.org/terracentral/2011/09/12/lake-erie-algae-bloom/

# Phosphorus Cycle



Harvest export

Fertilizer

Erosion/ Runoff

**Soil Organic Matter**

Mineralization

Imobilization

Microbial/ plant uptake

$H_2PO_4^-$

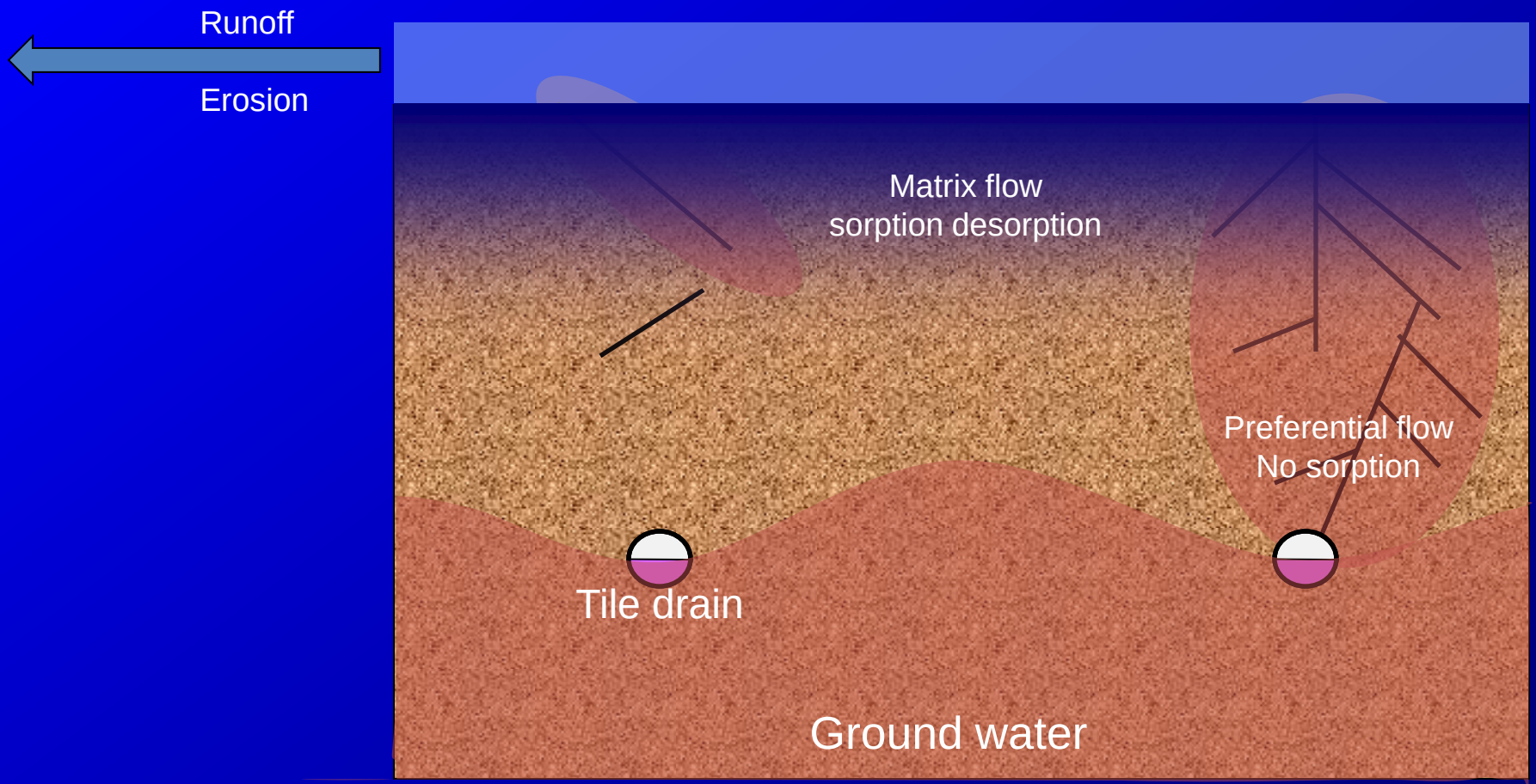
$HPO_4^{-2}$

$PO_4^-$

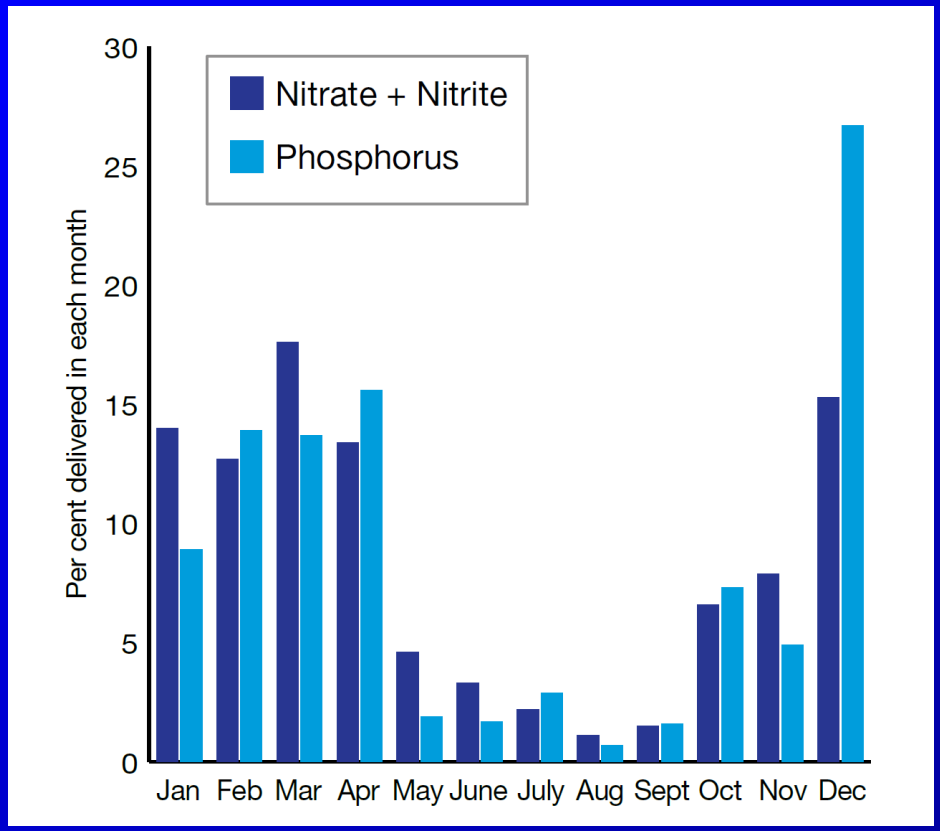
Leaching

Precipitates of (Ca, Fe, Al)

# Pathways of Water Flow in Soils



# How much Leaves the Field and How can we Manage it?

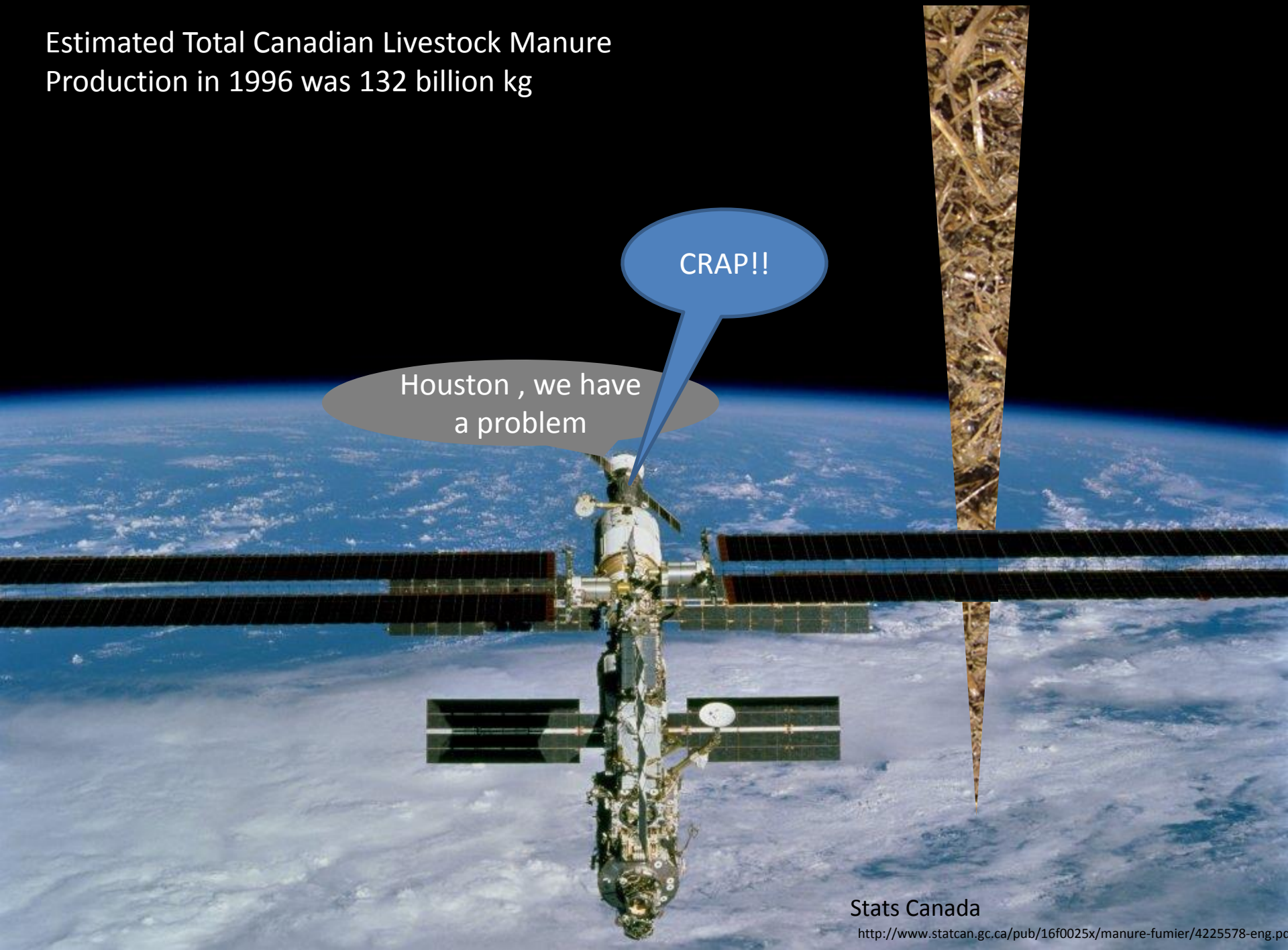



MOECC, 2012

May - Oct

Nov - Apr

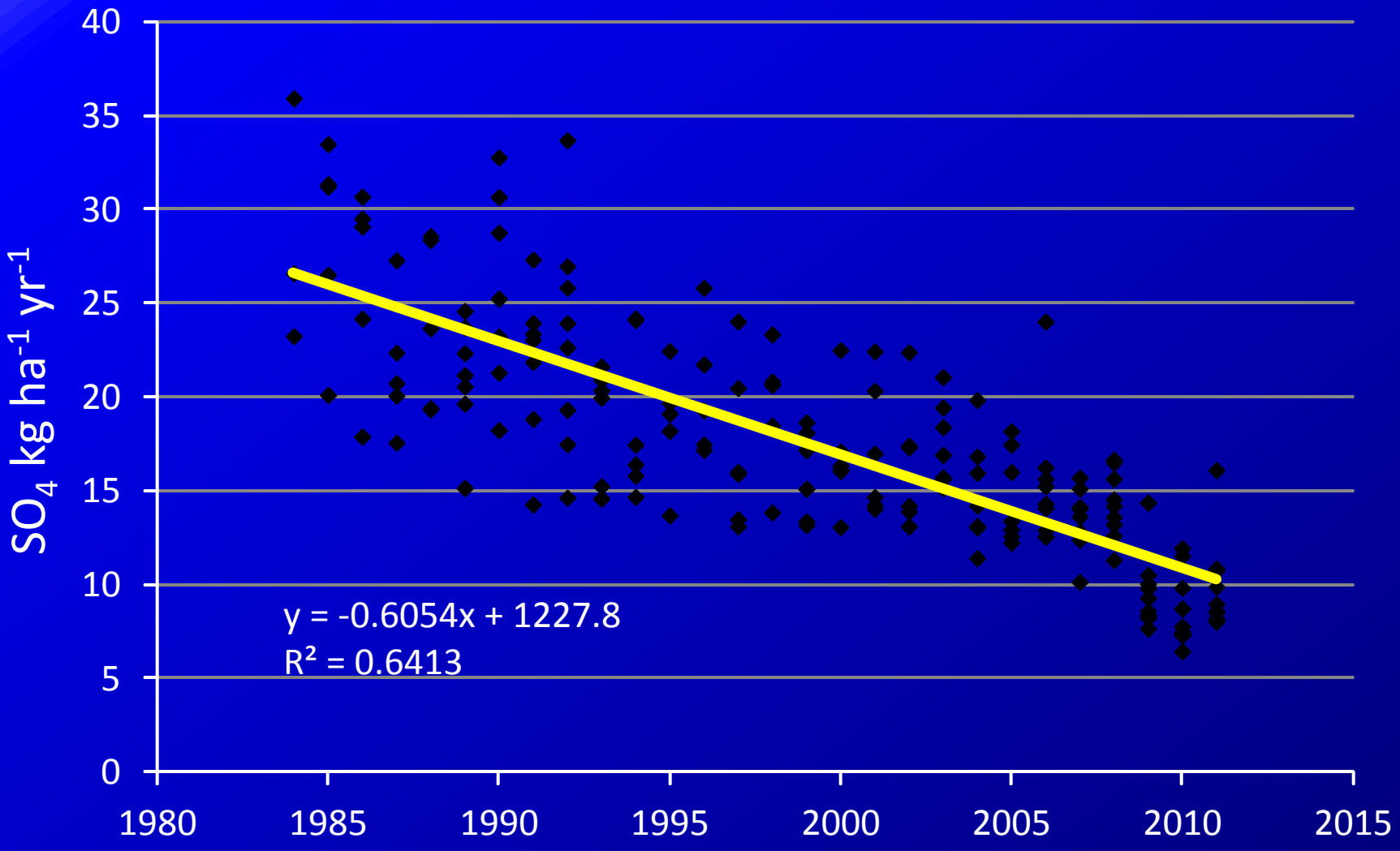
Estimated Total Canadian Livestock Manure Production in 1996 was 132 billion kg




Stats Canada

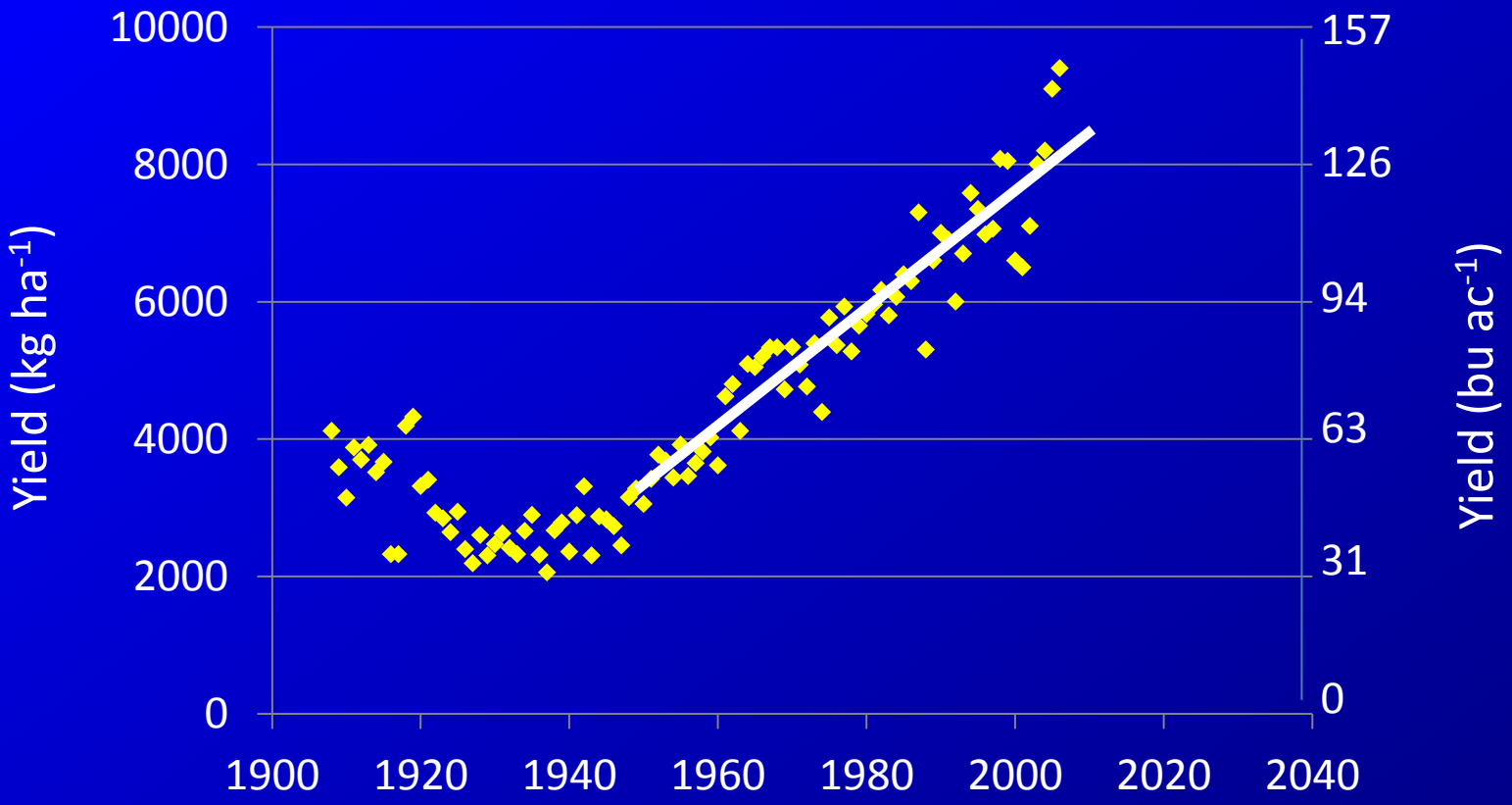
http://www.statcan.gc.ca/pub/16f0025x/manure-fumier/4225578-eng.pd

# $SO_4$ Deposition From Environment Canada Monitoring Sites, Northern Sites Removed




Adapted from Environment Canada data

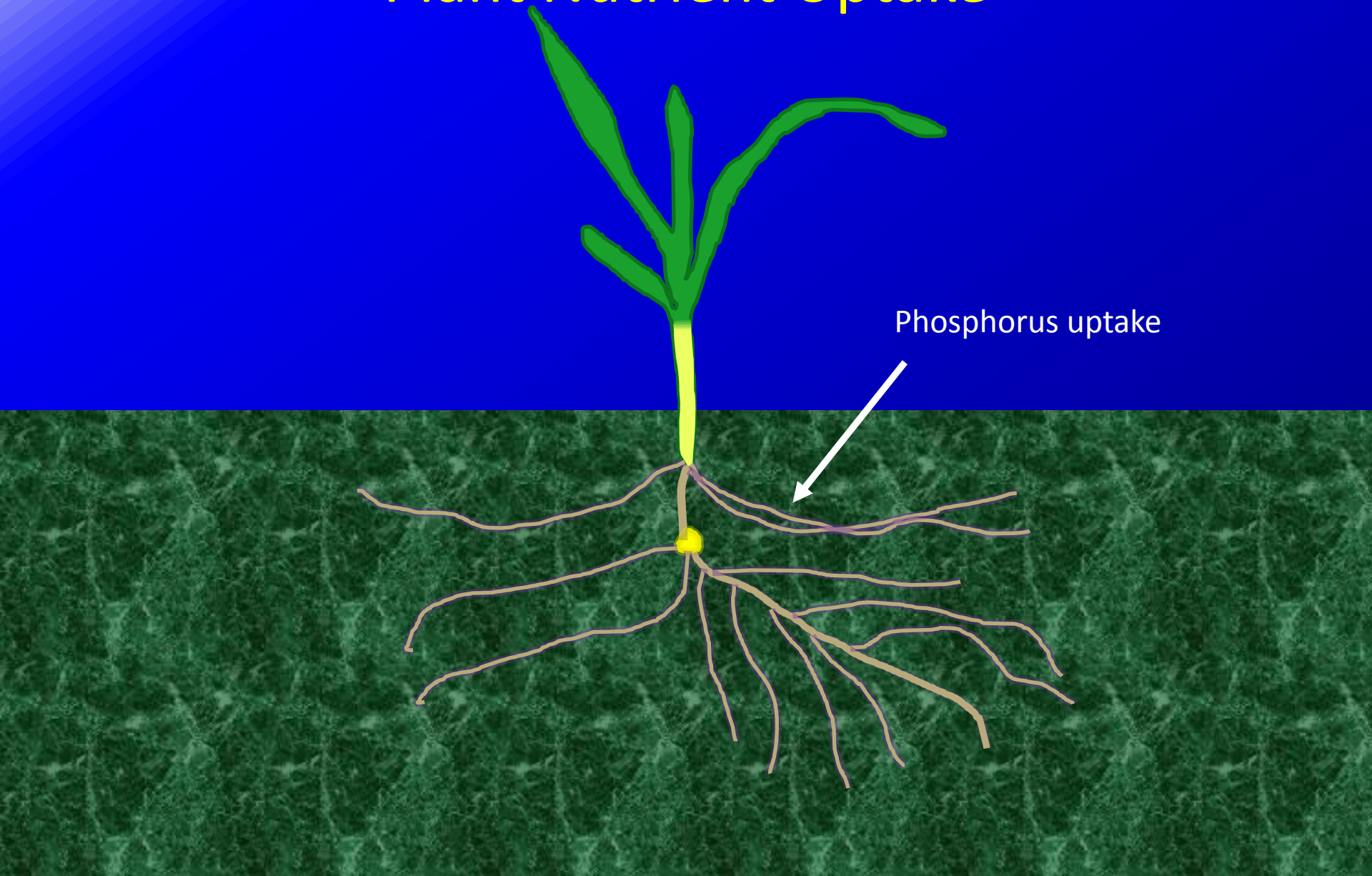
# Corn Yield in Ontario, 1908 - 2010



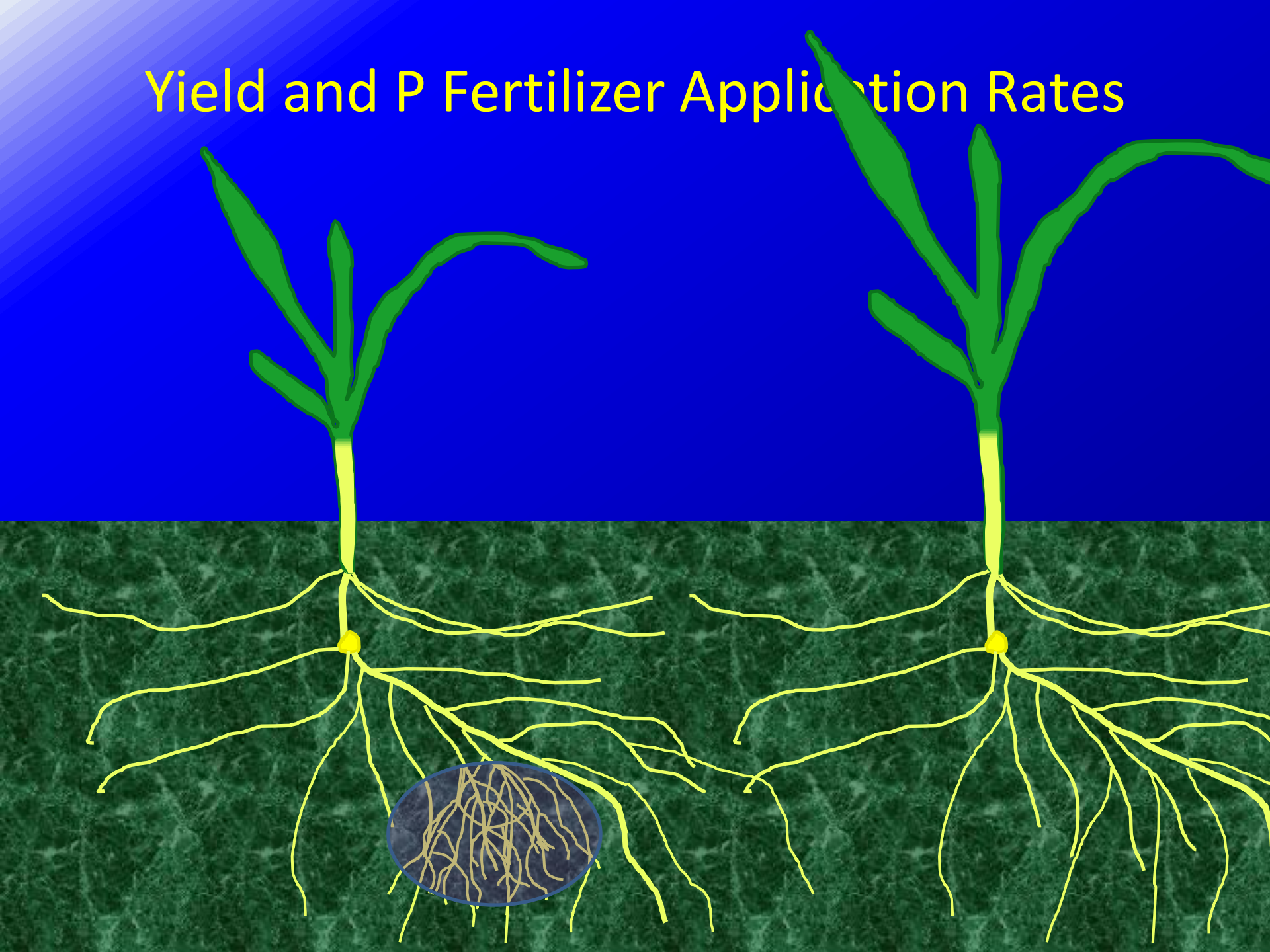

Since 1950 yield has increased by 85 kg/ha/yr (1.3 bu/ac/yr) or yield is 3.3 times greater than 1940 -45

Adapted from , Agricultural Statistics for Ontario

# Plant Nutrient Uptake



# Yield and P Fertilizer Application Rates



# Tests of the OMAFRA Soil Test P Calibration in Ontario (1980 - 1994)

| Crop | Number of trials | Trials with OMAFRA Rate sufficient |
|---|---|---|
| Corn | 47 | 43 |
| Soybean | 28 | 27 |

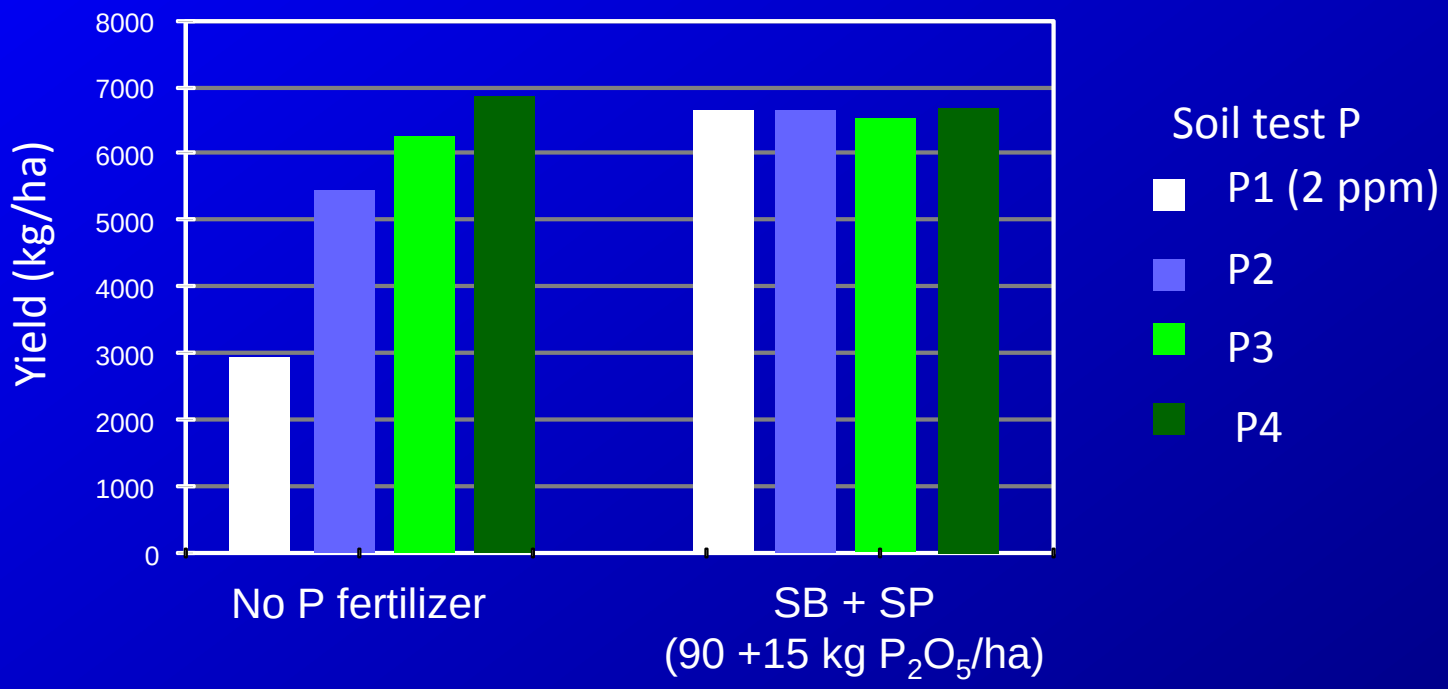
(Agdex 057, 1997)

# Tests of the OMAFRA Soil Test K Calibration in Ontario (1980 - 1994)

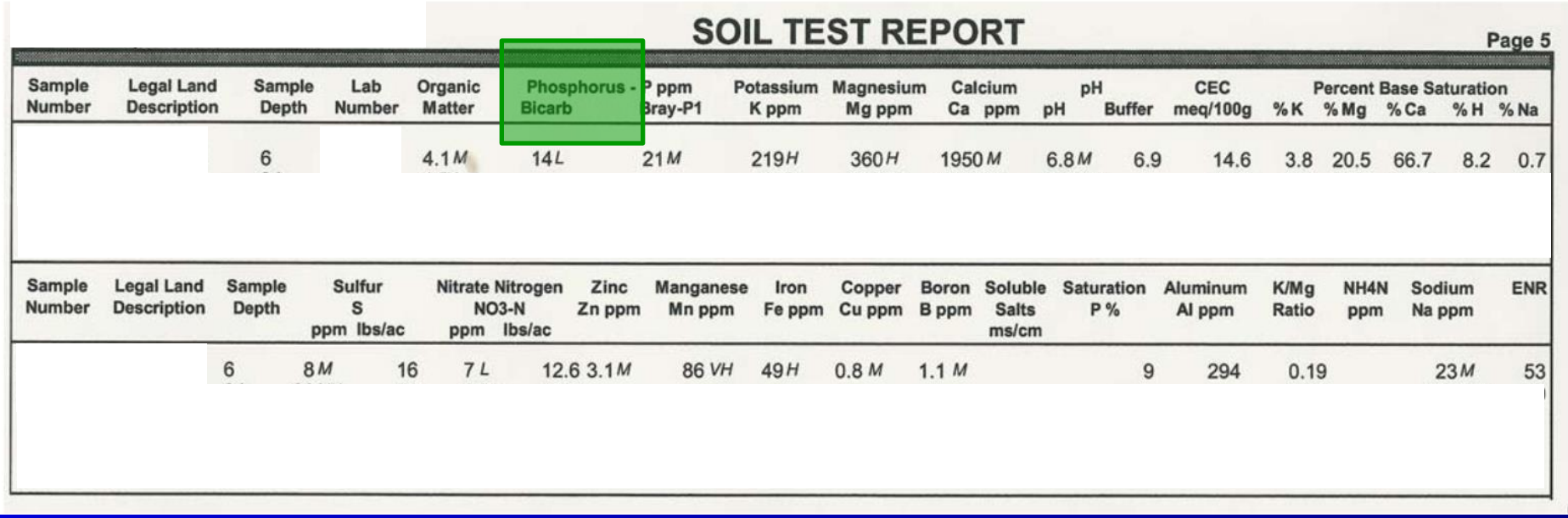
| Crop | Number of trials | Trials with OMAFRA Rate sufficient |
|---|---|---|
| Corn | 22 | 19 |
| Soybean | 19 | 16 |

(Agdex 057, 1997)

# Yield Response to Applied vs Soil Test P



# Soil Test Report



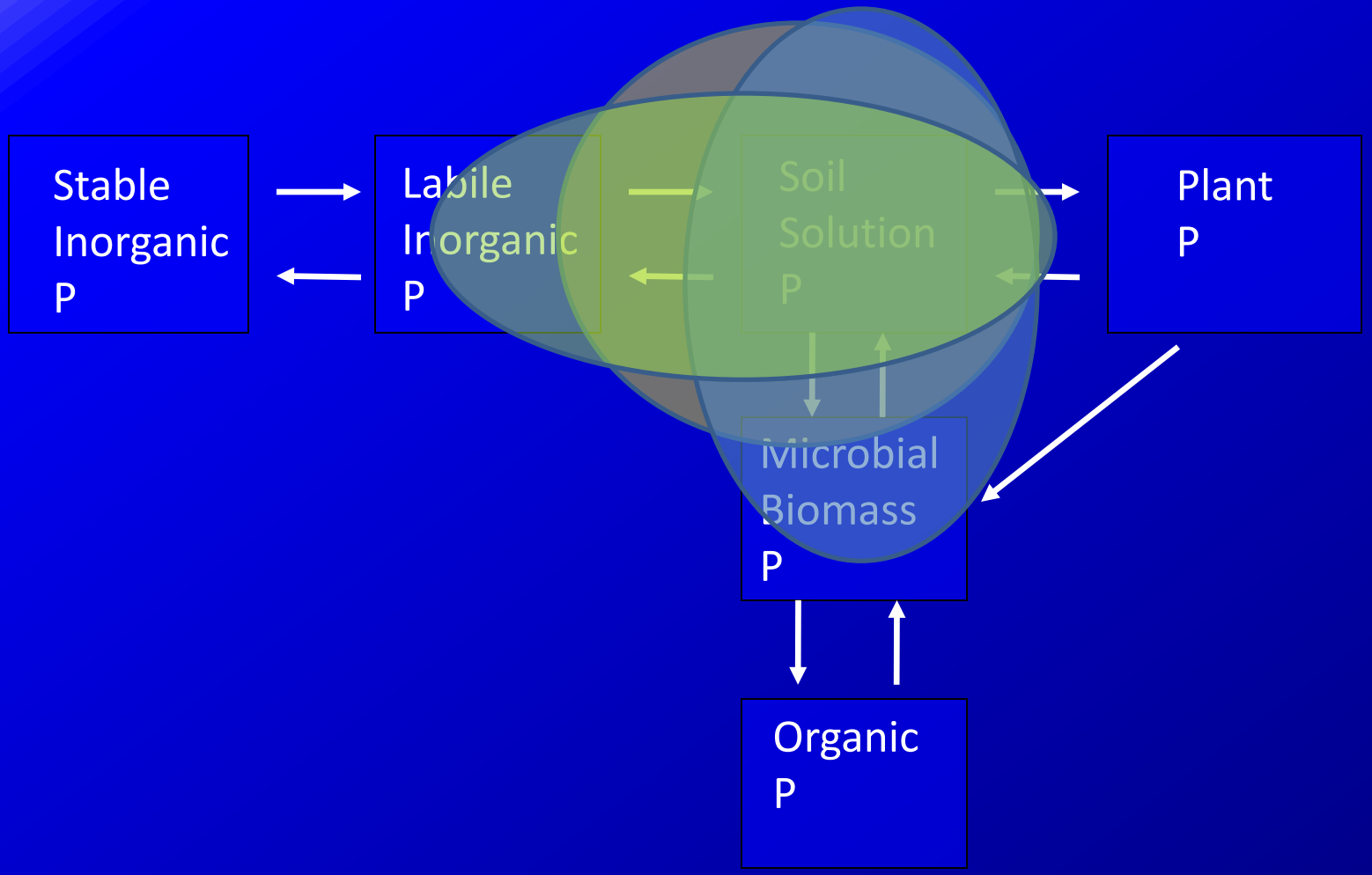
## SOIL TEST REPORT

Page 5

| Sample Number | Legal Land Description | Sample Depth | Lab Number | Organic Matter | Phosphorus - Bicarb | P ppm Bray-P1 | Potassium K ppm | Magnesium Mg ppm | Calcium Ca ppm | pH | Buffer | CEC meq/100g | Percent Base Saturation % K | % Mg | % Ca | % H | % Na |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 6 | | 4.1 *M* | 14 *L* | 21 *M* | 219 *H* | 360 *H* | 1950 *M* | 6.8 *M* | 6.9 | 14.6 | 3.8 | 20.5 | 66.7 | 8.2 | 0.7 |

| Sample Number | Legal Land Description | Sample Depth | Sulfur S ppm | Sulfur S lbs/ac | Nitrate Nitrogen NO3-N ppm | Nitrate Nitrogen NO3-N lbs/ac | Zinc Zn ppm | Manganese Mn ppm | Iron Fe ppm | Copper Cu ppm | Boron B ppm | Soluble Salts ms/cm | Saturation P % | Aluminum Al ppm | K/Mg Ratio | NH4N ppm | Sodium Na ppm | ENR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 6 | 8 *M* | 16 | 7 *L* | 12.6 | 3.1 *M* | 86 *VH* | 49 *H* | 0.8 *M* | 1.1 *M* | | 9 | 294 | 0.19 | | 23 *M* | 53 |

# Soil/Plant Phosphorus

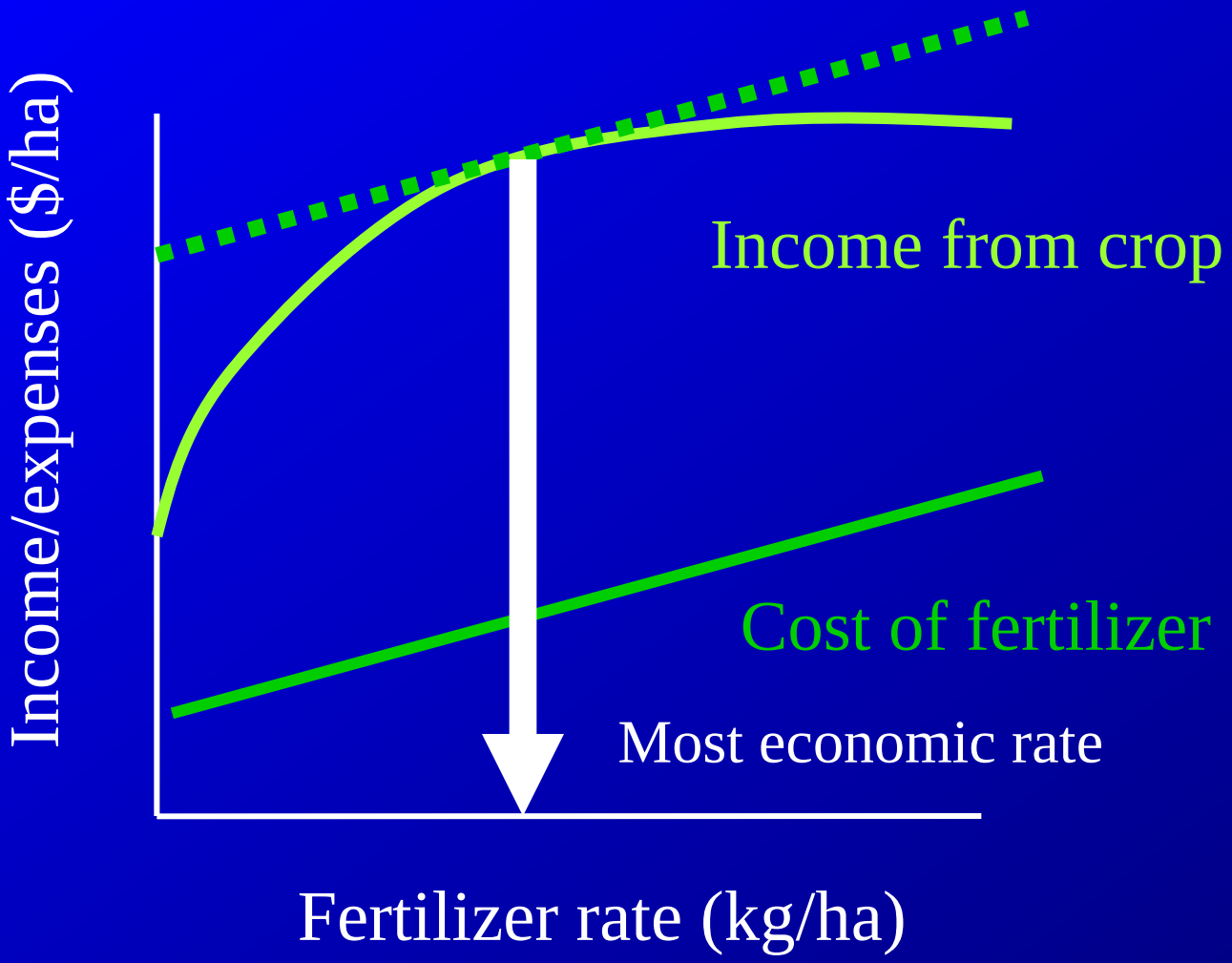


# Correlation of Extractable P with P Uptake

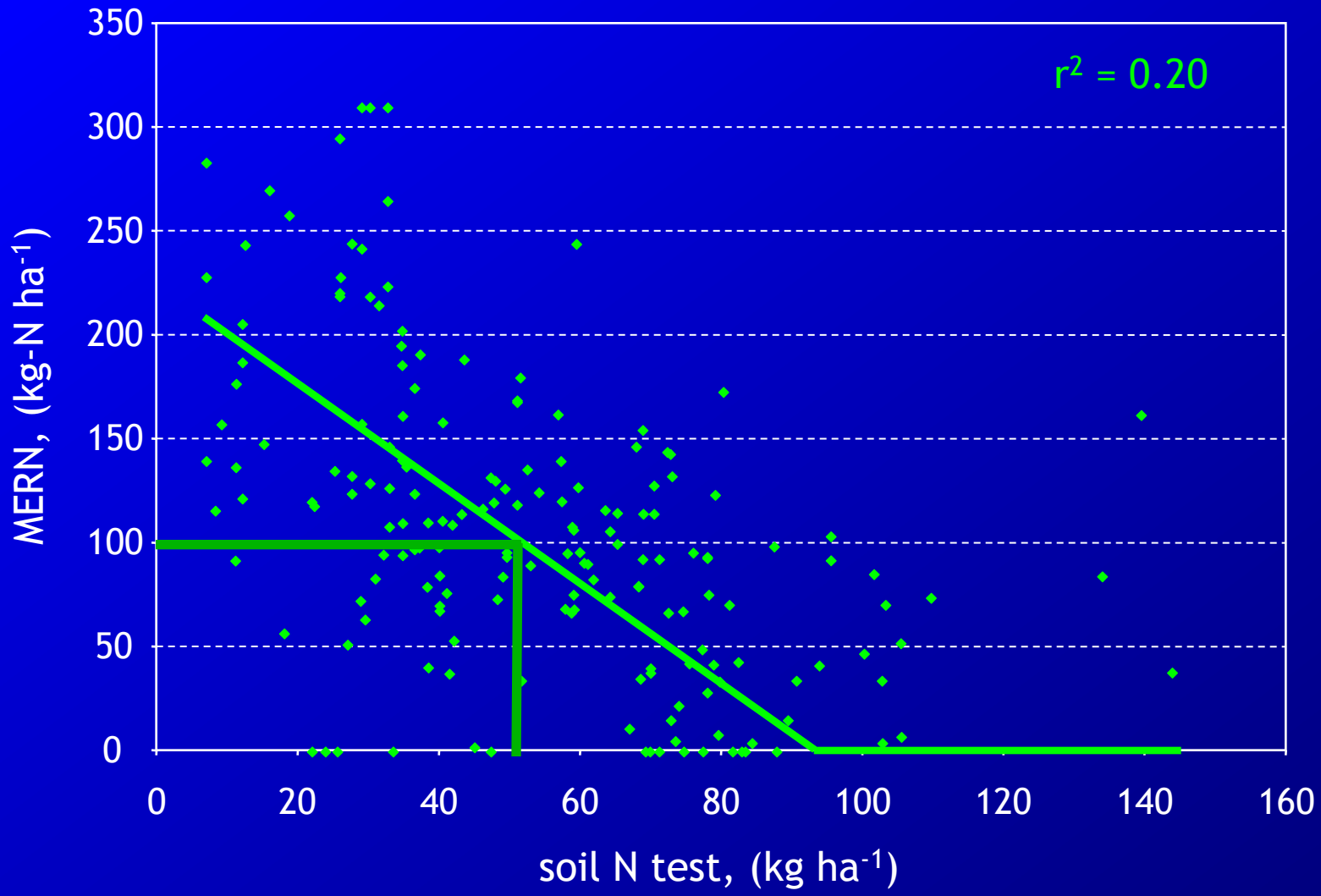
| Extractant | All soils (88 soils) | pH > 7.0 (46 soils) | pH 6.1 - 7.0 (30 soils) | pH < 6.1 (12 soils) |
|---|---|---|---|---|
| | | $r^2$ | | |
| Na $HCO_3$ | 0.74 | 0.79 | 0.64 | 0.87 |
| AB-DTPA | 0.73 | 0.71 | 0.63 | 0.95 |
| Bray P1 | 0.54 | 0.52 | 0.33 | 0.73 |
| Bray P2 | 0.65 | 0.60 | 0.40 | 0.90 |
| Mehlich 3 | 0.66 | 0.57 | 0.40 | 0.93 |

(Bates, 1990)

# Economics of Fertilizer Application



# MERN vs N Test



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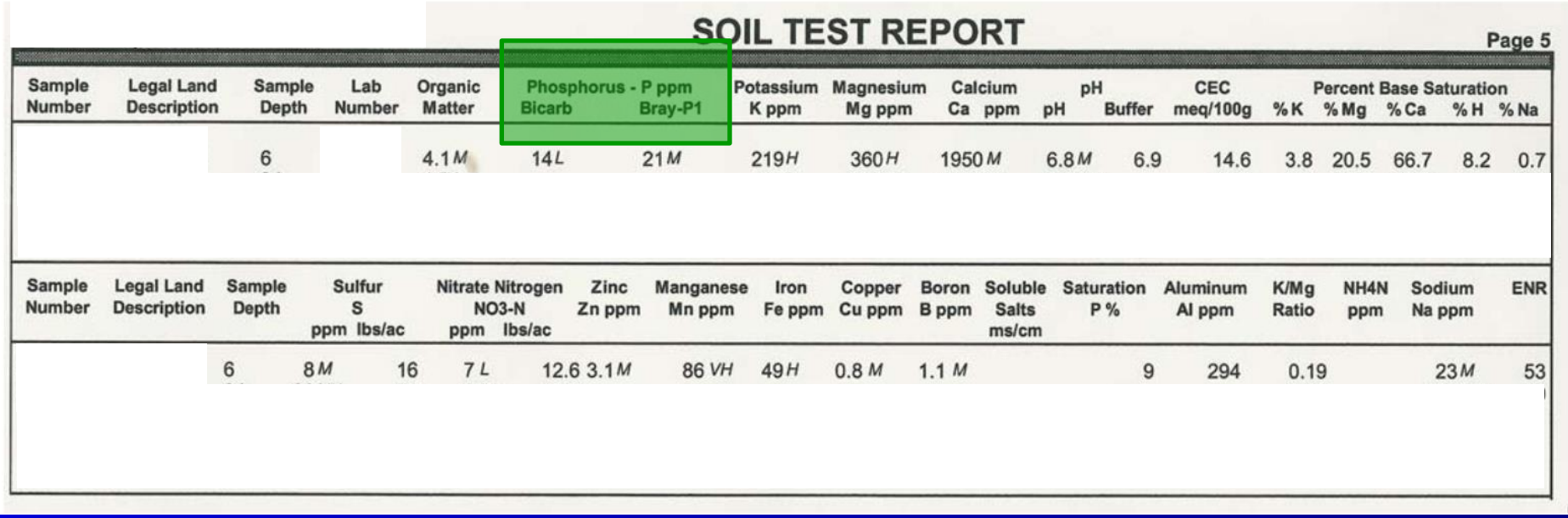

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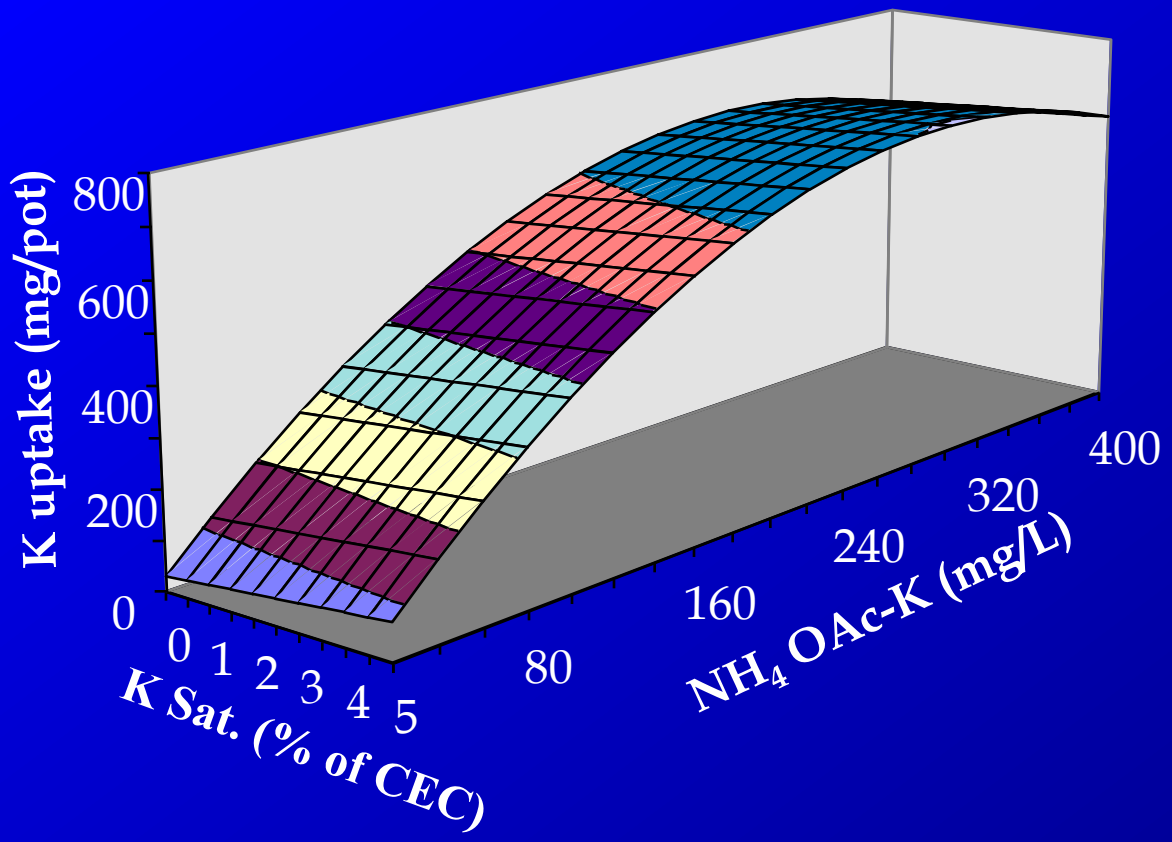
# Impact of Potassium Saturation and Soil Test K Levels on Plant K Uptake




Greenhouse trial with 67 soils growing alfalfa

Other studies have also found similar results Reid 1996 had Ca:Mg ratios ranging form 267:1 to 1:1 without advers affect on plant

# Soil Health Tests

- Often include soil test as a measure
- For example the Haney soil health test: “extractant is composed of organic root exudates, lithium citrate, and two synthetic chelators (DTPA, EDTA)”
- The report indicates that “a good soil extractant would mimic the soil environment“
- None of these soil nutrient tests have been calibrated for Ontario conditions