

# Potato Industry Fertilizer Conservation Efforts

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# Topics Covered

- Potato Production
- Potato Growth
- Nutrient Accessibility & Availability
- Nutrient Requirements
- Fertilizer (Nutrient) Use Efficiency





# Overview of Potato Production - 2015

- Total United States Planted Acres – 1,071,600
  - Idaho – 321,000
  - Washington – 170,000
  - North Dakota – 80,000
  - Wisconsin – 66,000
  - Colorado – 59,000
  - Maine – 51,000
  - Minnesota – 50,000
  - Michigan – 46,000
  - Oregon – 39,000





# Overview of Potato Growth

- I – Planting to Crop Emergence
- II – Vegetative Growth
- III – Tuber Initiation
- IV – Tuber Bulking
- V – Tuber Maturation





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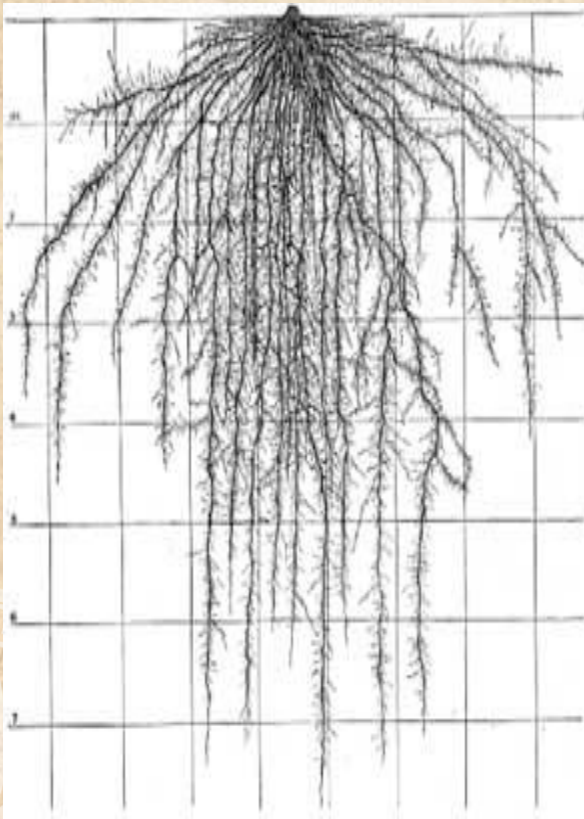




# Factors Affecting Nutrient Accessibility

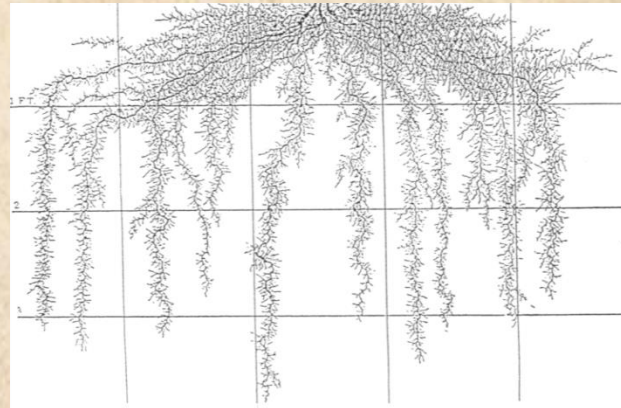
- Understand root structure of plant being grown

Mature Corn plant



Adapted from Weaver, 1926

Mature Potato plant

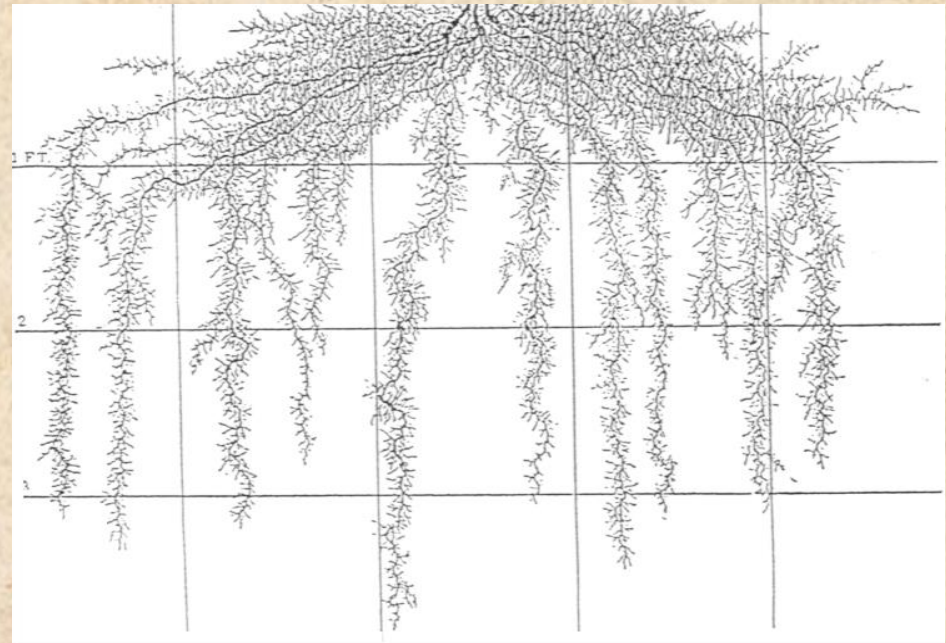


Adapted from Weaver, 1926



# Factors Affecting Nutrient Accessibility

- Compaction from previous crops
- Compaction from planting or cultivation events
- Saturated soil conditions



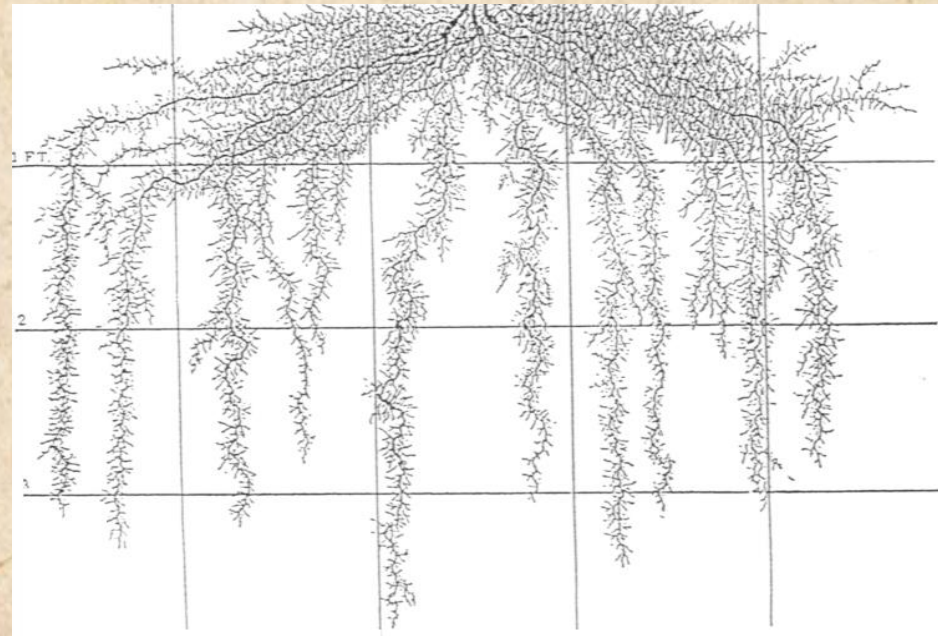
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# Factors Affecting Nutrient Accessibility

- Soil-borne pathogens
  - Rhizoctonia, Pythium, Phytophthora, Colletotrichum, Verticillium
- Plant pathogenic nematodes
  - Stubby-root and Lesion
- Herbicide damage
- Fertilizer burn
- Mechanical damage



Adapted from Weaver, 1926





# Factors Affecting Nutrient Availability

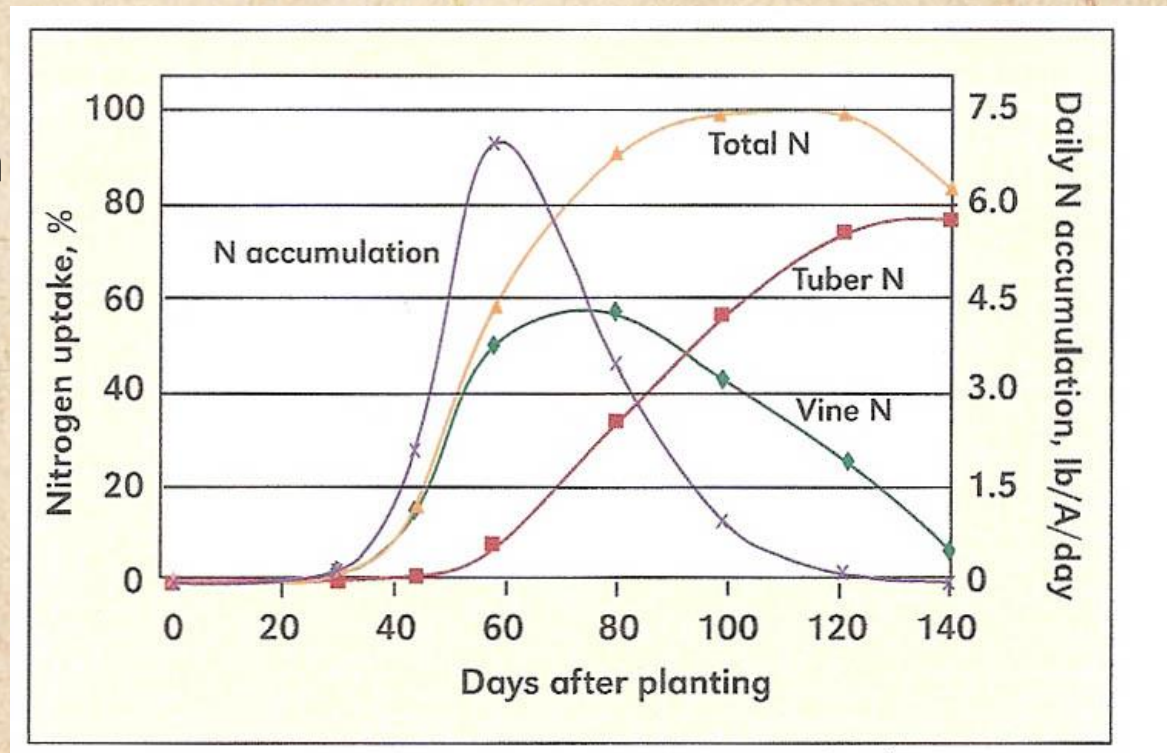
- Inadequate soil pH
- Microbial immobilization (C:N ratio of debris)
- Volatilization (N)
- Leaching (N,K,S,B)
- Denitrification (N)
- Surface runoff (N & P)





# Nutrient Requirements

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Potato Seasonal N Accumulation &  
Daily Accumulation Rate. Courtesy of Carl Rosen





# Nutrient Requirements

- Potato phosphorus uptake per 100 cwt
  - Vines ~ 0.6 lb P/A
  - Tubers ~ 5.6 lb P/A
  - Total ~ 6.2 lb P/A (14.3 lb  $P_2O_5$ /A)
- Potato potassium uptake per 100 cwt
  - Vines ~ 6.6 lb K/A
  - Tubers ~ 38.4 lb K/A
  - Total ~ 45.0 lb K/A (54 lb  $K_2O$ /A)

Relative Soil Test Level	Probability of Response to Applied Fertilizer	Bray P1	NH <sub>4</sub> OAc K
		----- ppm -----	
Low	> 90%	0-10	0-40
Medium	60-90%	11-20	41-80
Medium-high	30-60%	21-30	81-120
High	10-30%	31-40	121-160
Very high	<10%	41+	161+

**Average of 2017 Minnesota Potato Fields**

**56**

**156**

**On average, P205 application reduced by 65% since 2011**





# Nutrient Requirements

- How much Nitrogen is required
  - Tubers are 1.2 – 1.5%N on dry wt basis
  - Tubers average 20 – 21% dry matter in Minnesota

FW Yield (cwt/a)	Dry Matter (%)	DW Yield (cwt/a)	Tuber N (lb/a)	Vine N (lb/a)	Total N (lb/a)
600	20	120	180	40-90	220 – 270
500	20	100	150	40-90	190 – 240
400	20	80	120	40-90	160 – 210

Average nitrogen application in Minnesota is 250-270 lb/a.

Average Minnesota Yield is < 500 cwt/a

Room for improvement in Nitrogen Use Efficiency





# How do we increase Nitrogen use efficiency?

- Use realistic yield goals
- Manage soil-borne diseases
- Encourage roots to explore maximum soil volume
- Apply the right amount at the right time
- Minimize volatilization and leaching
  - Polymer coated Urea
  - Urease inhibitors
  - Nitrification inhibitors





Reduce leaching with different spatial arrangement?





Reduce row width from 36" to 18" and eliminate row





Thank You



**R.D. OFFUTT**  
 **COMPANY**  
FARM DIVISION