Sustainable Potatoes in 2024

Old School & New School

Potatoes 401

Brett Reynolds
Reynolds Agribusiness

Sustainable Potatoes 2024 – Today’s Topics

- What Does “Sustainable” Mean?
- Where Have We Been ? Where Are We Going ?
- What I’ve Learned in 30 Years
    1. Water Management is Everything !!!
    2. Pay Attention to Your Soil Sample - Case Study
    3. Plant Health = Direct Relationship with Nutrition
    4. All Fertilizers Are Not Created Equal (Baggage/Solubility)
        - Carbon Complexed Nutrients are for Real
    5. Manures – How Can They Help ?
- Biology: How to Make Sense of it All…

Sustainable Potatoes in 2024

What Is Sustainability?

In the broadest sense, sustainability refers to the ability to maintain or support a process continuously over time. In business and policy contexts, sustainability seeks to prevent the depletion of natural or physical resources, so that they will remain available for the long term.

KEY TAKEAWAYS

- Sustainability is ability to maintain or support a process over time.
- Sustainability is often broken into three core concepts: economic, environmental, and social.

Definition of "Sustainability" from Investopedia.com

Our Tools Are Changing

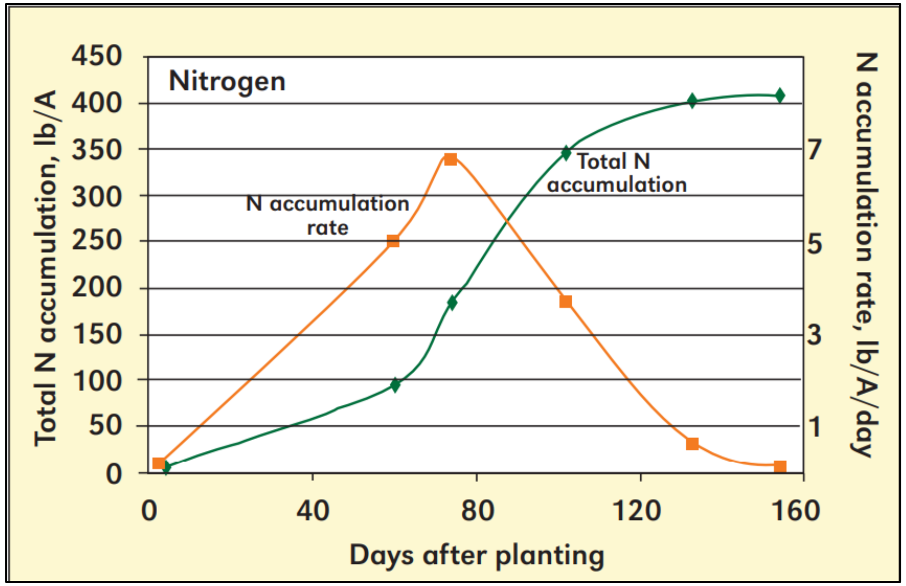
Where Have We Been ? – Old School	**Where Are We Going ? – New School**

Fumigation
Excessive Tillage ?
Full Coverage Chemistry
    Temik
    Monitor
    Neonics
Synthetic Fertilizers
Heavy Pre-Plant Applications
Raw Manures
	Fumigation ???
	Improved Tillage Equipment
	Pest Specific Chemistry
	    Neonics ??
	Fertilizer Technology
	Manures /Compost
	Irrigation Technologies
	Tissue/Soil Analysis
	More Targeted Applications
	Better Information

Water is a **BIG** Deal

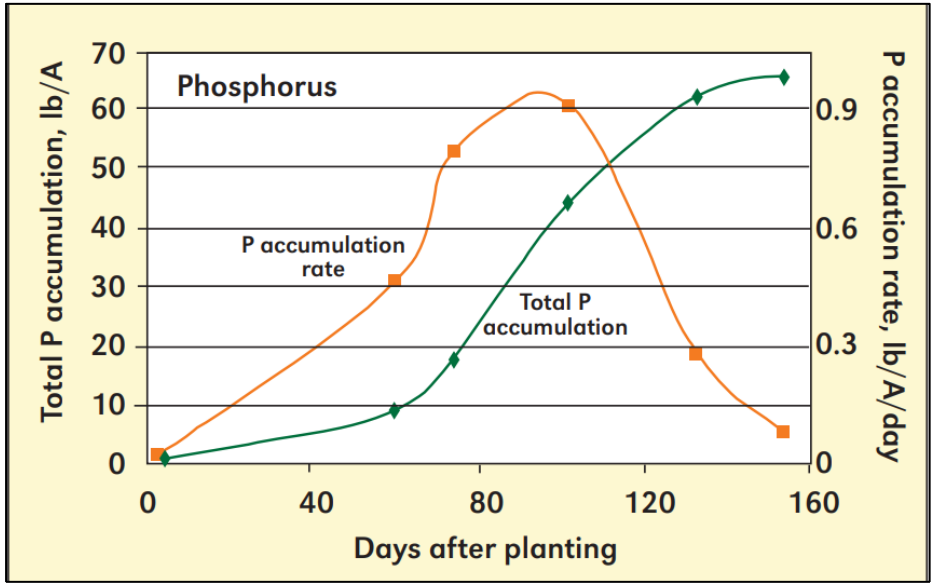
- 24 inches of water = 5.2 million pounds
- All other crop inputs = < 50,000 pounds

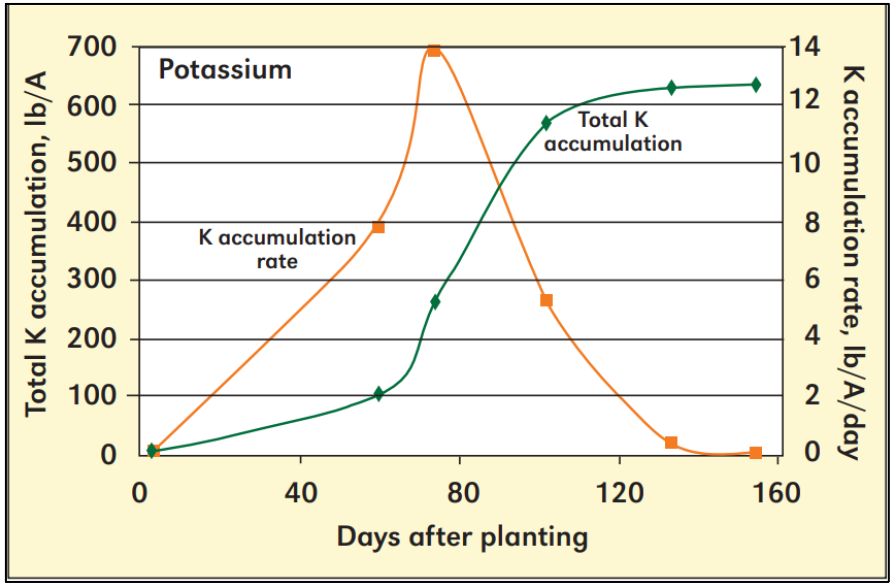
Nutrient Demand in Potatoes



N

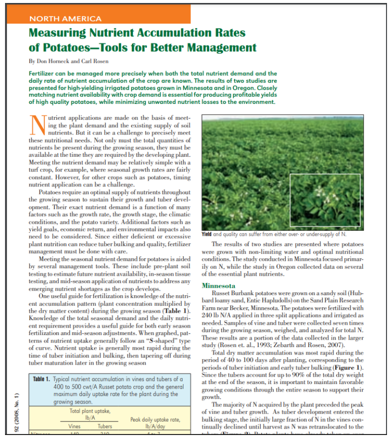
P





K

Horneck & Rosen 2008



NORTH AMERICA

Measuring Nutrient Accumulation Rates of Potatoes—Tools for Better Management

By Don Horneck and Carl Rosen

CY24 Spud Field Soil Sample

- pH
- Base Distribution/Saturation
- CEC

- Bulk Density
- PPM or lbs/acre foot

Should I Lime ??

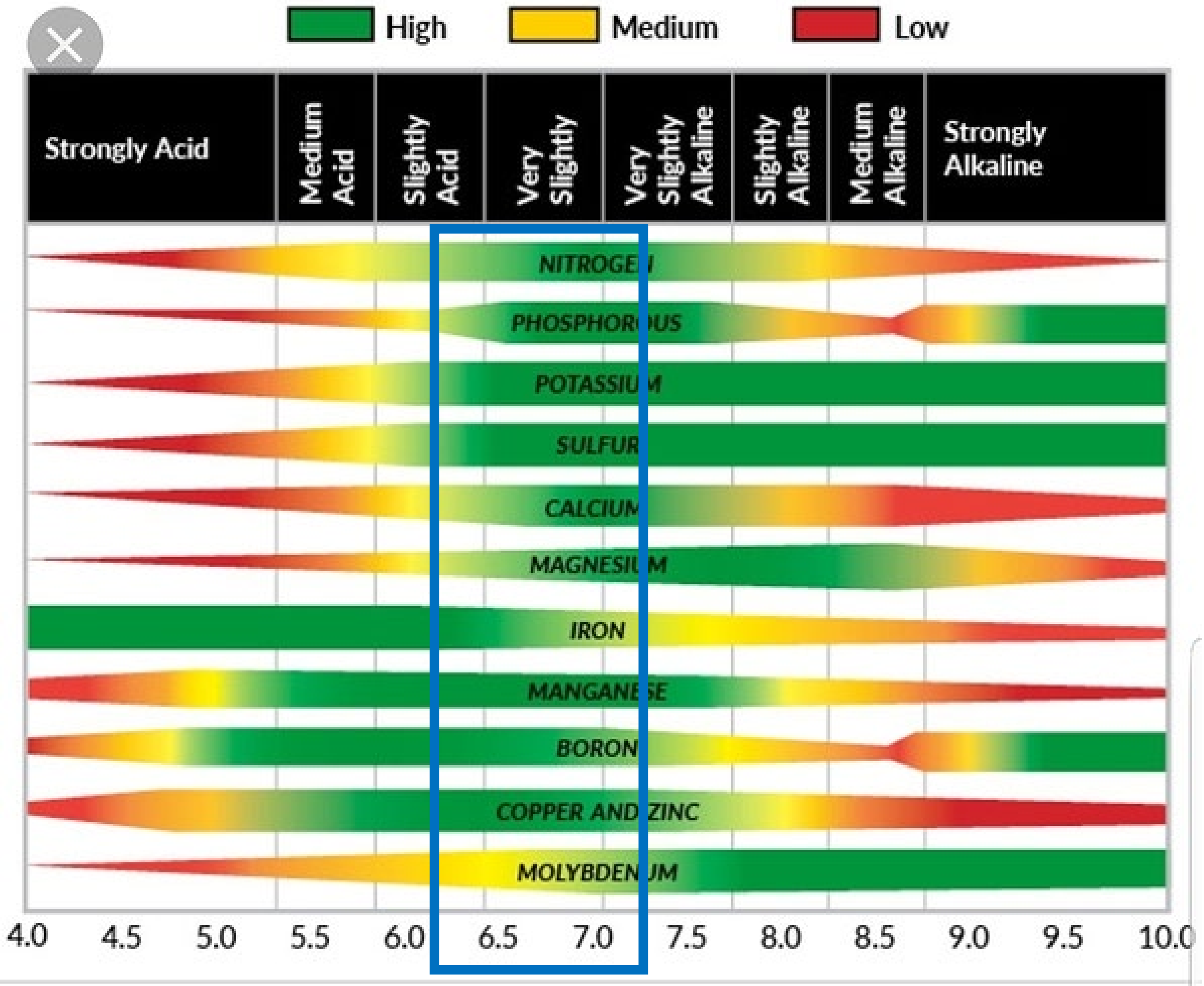
NUTRIENTS	Soil Bulk Density	NO3N (1N KCl)	NO3N	NH4N (1N KCl)	NH4N	SO4S (DTPA-Sorb.)	SO_4S	Avail. H_2O
Depth (inches)	million lbs/acre-depth	ppm (mg/kg)	lbs/acre-depth	ppm (mg/kg)	lbs/acre-depth	ppm (mg/kg)	lbs/acre-depth	inches/depth
0/12	**4.30**	**12.2**	**52**	**1.1**	**5**	**9**	**39**	
Total (sum of depths) lbs/acre			52		5		39	
Estimated N Release from Organic Matter (ENROM)			52				**Total Available Moisture =**	
Sum of Available N (NO3N + NH4N + ENROM)			109				**Available Moisture % 1st Depth =**	

1st depth results	Extraction Method		ppm (mg/kg)	lbs/acre-depth		*Interpretation (1st depth)*
Phosphorus, Olsen	($0.5N\ NaHCO_3$)	(PO_4P)	**25**	246	(P_2O_5)	Medium High
Phosphorus, Bray P1	(NH_4F, HCl)	(PO_4P)			(P_2O_5)	
Phosphorus, Bray P2	(NH_4F, HCl x 4)	(PO_4P)			(P_2O_5)	
Potassium, Olsen	(0.5N NaHCO3)	(K)	**137**	710	(K_2O)	Medium
Boron	(DTPA-Sorb)	(B)	**0.3**	1.3	(B)	Low
Zinc	(DTPA-Sorb)	(Zn)	**1.9**	8.1	(Zn)	Medium High
Manganese	(DTPA-Sorb)	(Mn)	**1.8**	7.7	(Mn)	Low
Copper	(DTPA-Sorb)	(Cu)	**1.1**	4.7	(Cu)	Medium
Iron	(DTPA-Sorb)	(Fe)	**78**	335	(Fe)	Very High
Molybdenum	(DTPA-Sorb)	(Mo)	**0.008**	0	(Mo)	Very Low
Aluminum	(DTPA-Sorb)	(Al)			(Al)	
Aluminum	(1N KCl)	(Al)			(Al)	
Chloride	(ISE Buffer)	(Cl^-)			(Cl^-)	

SOIL CHARACTERISTICS		1st Depth	2nd Depth	3rd Depth	4th Depth	*Interpretation (1st depth)*
pH		**6.03**				Slightly Acidic
Electrical Cond.	(EC 1:1) (dS/m)	**0.24**				
~ Soluble Salts	(Sat. Paste) (dS/m)	**0.62**				Negligible salt effects
Organic Matter %	(Walkley-Black)	**1.30**				Medium Low
Effervescence	(Scale = 0 to 7)	**0**				Very Low
%Lime (Calcium Carbonate (CaCO3))						

EXCHANGEABLE BASES	Typical ranges in %	% of Total Bases	% of CEC	meq/100g	ppm (mg/kg)	lbs/ac-depth	Buffer pH for lime req.	
Calcium (Ca)	(55 - 75)	71.4%	55.0%	**5.5**	1100	4730	pH_{Ca} =	
Magnesium (Mg)	(15 - 30)	22.1%	17.0%	**1.7**	207	889	pH_{Sikora}	
Sodium (Na)	(0.1 - 5)	2.2%	1.7%	**0.17**	39	168	pH_{A-E} =	
Potassium (K)	(2 - 8)	4.5%	3.5%	**0.35**	137	588	**Texture**	
Total Bases (Ca + Mg + Na + K)		100.3%		**7.7**			Sand%	
~ Cation Exchange Capacity (CEC)				**10.0**			Silt%	
~ Percent Base Saturation (TB/CEC)			**77%**				Clay%	

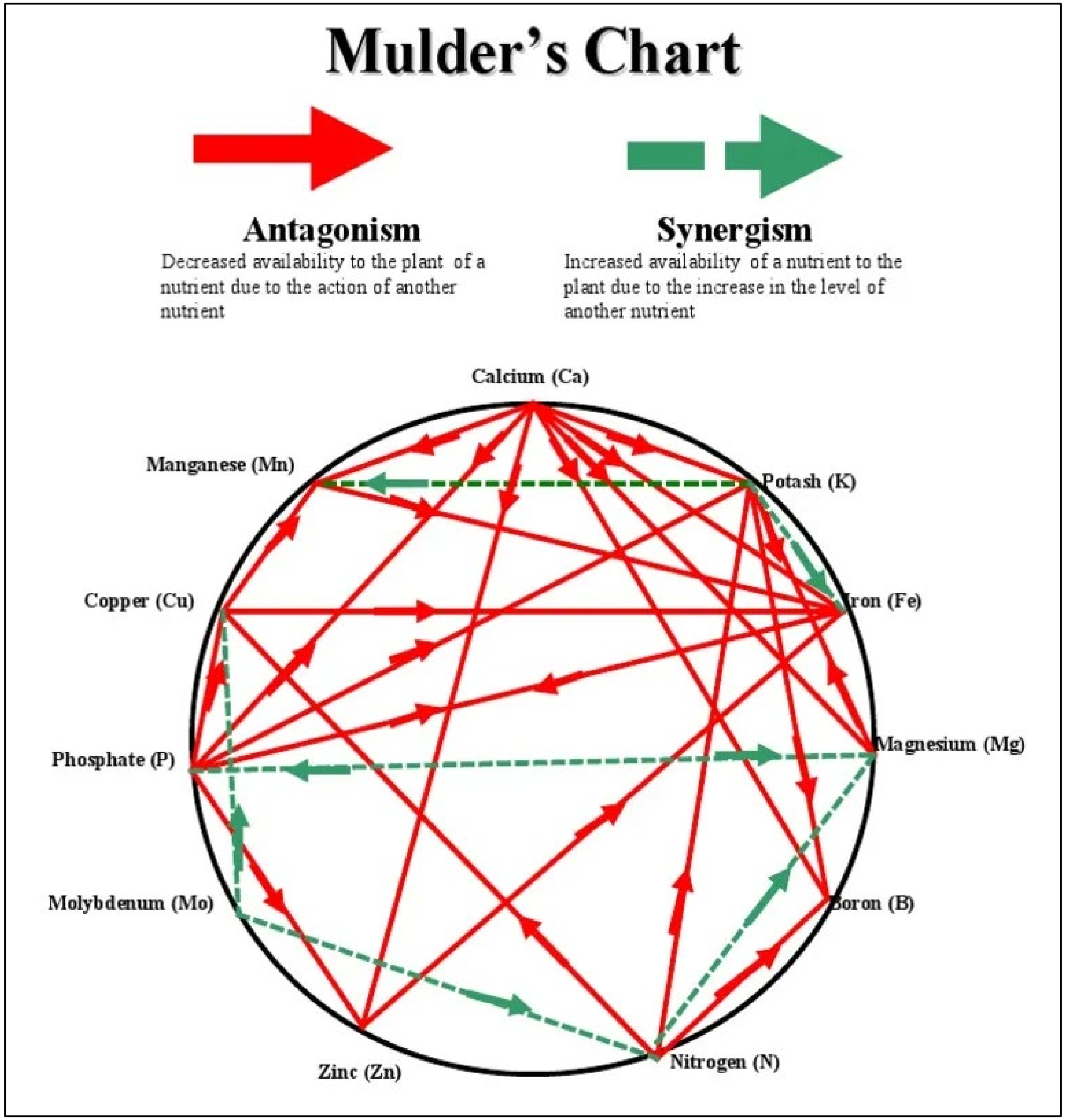
Soil pH and Nutrient Availability



Nutrient Interactions

- Molybdenum & Nitrogen
- Calcium and Phosphorus

- Calcium = Bad at Relationships ?



Plant Health = Direct Relationship with Nutrition

	Nitrogen (N)	Phosphorus (P)	Potassium (K)	Magnesium (Mg)	Sulphur (S)	Calcium (Ca)	Boron (B)	Copper (Cu)	Chlorine (Cl)	Iron (Fe)	Zinc (Zn)	Nickel (Ni)	Manganese (Mn)	Molybdenum (Mo)	Cobalt (Co)	Silicon (Si)	Selenium (Se)	Sodium (Na)
Nodulation/ Nitrogen Use	Y				Y	Y				Y		Y		Y	Y			
Photosynthesis	Y		Y	Y	Y			Y	Y	Y	Y		Y			Y	Y	
Disease Resistance			Y		Y	Y	Y	Y	Y	Y			Y			Y	Y	
Abiotic Stress Tolerance			Y			Y	Y	Y		Y	Y		Y	Y				
Carbohydrate Production		Y	Y	Y				Y					Y					
Protein Production	Y			Y	Y						Y			Y				
Oil Production				Y	Y													
Vegetative Growth	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y	Y	Y			
Hormone Metabolism				Y				Y			Y			Y				
Root Growth		Y				Y	Y											
Energy Transfer		Y		Y	Y			Y	Y	Y								
Nutrient Uptake		Y	Y	Y			Y		Y									
Water Usage			Y			Y			Y									Y

Chart not Created or Owned by Presenter – Found on NutriAg.com

Not All Fertilizers are Created Equal…

- Salt Index
- Solubility Index
- Nutrient Interactions
- Baggage/Unintended Consequences
- Protected Nutrients

Manures

How Can They Help?

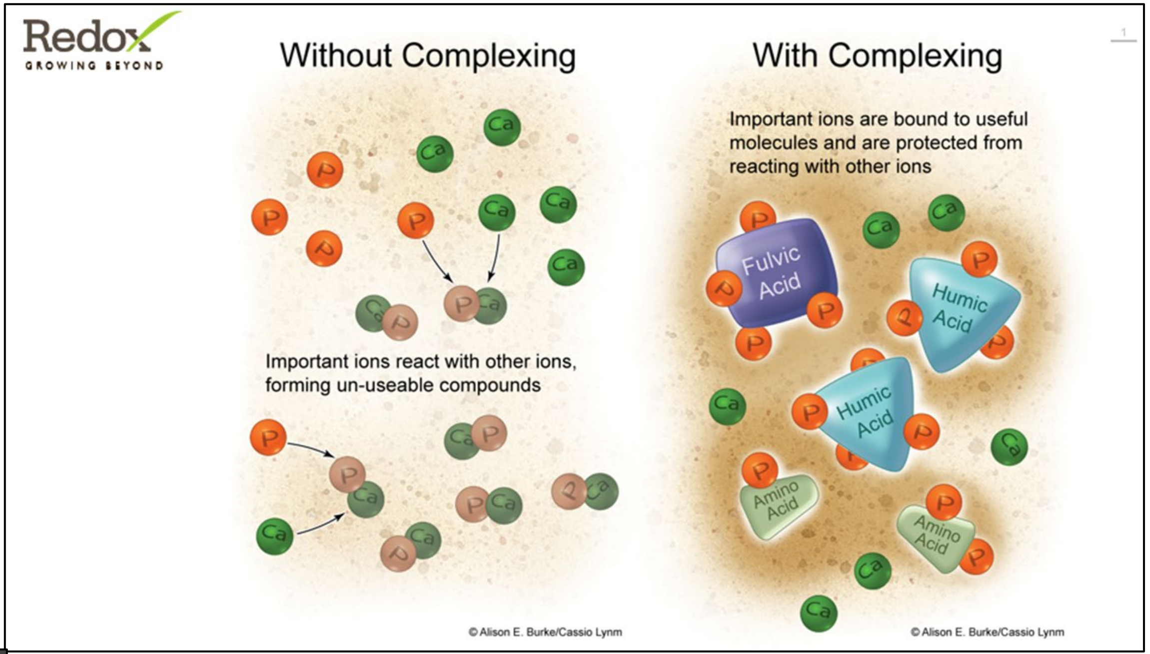
- Carbon
- Abundant Calcium
- Great Source of P & K

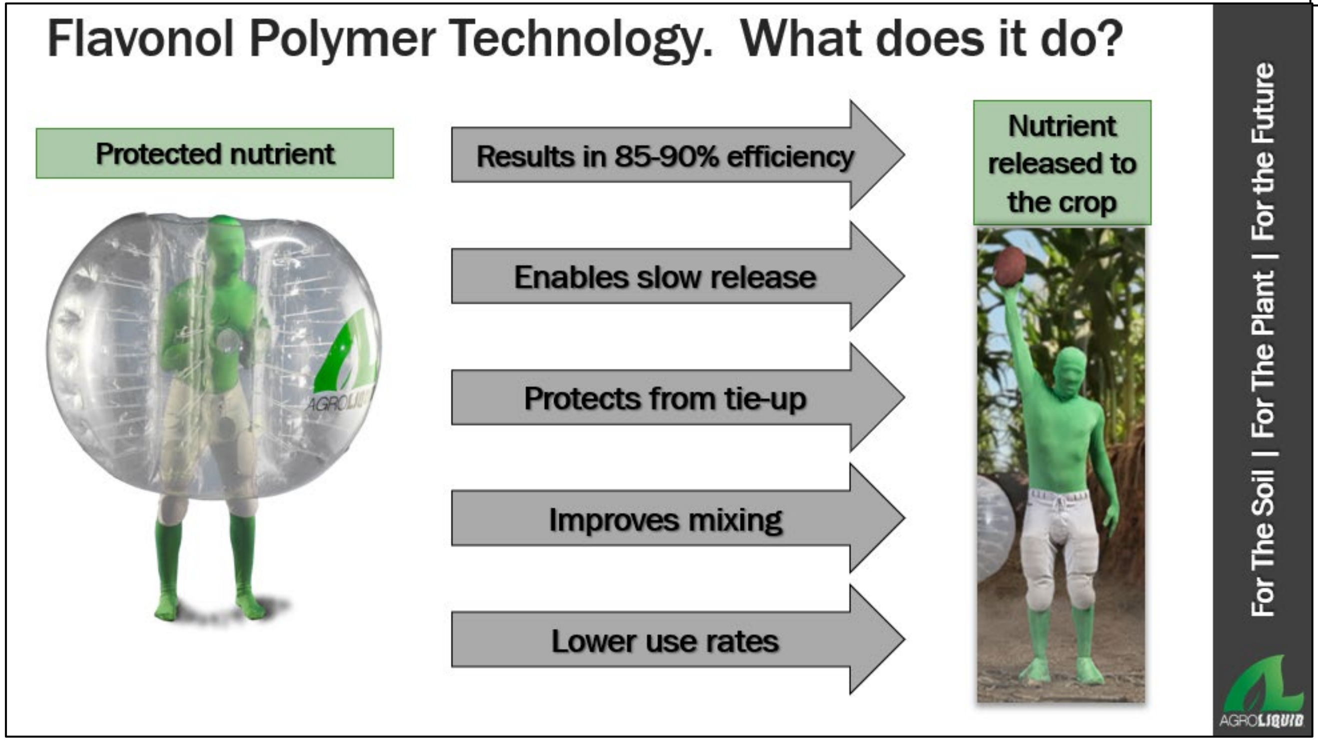
- What is available in 1st year ?
  - 2% Acetic Acid Test

- What about "salts" ?

Bulk Density	0.49 g/ml	0.41 tons/cu yd	
Analyte	100% Dry Matter Basis	As Received Basis	Lbs / Ton (As Received)
pH		7.2	
Electrical Conductivity (dS/m) (1:2)		17.8 dS/m (mmhos/cm)	
Dry Matter	100.00 %	83.53 %	1671
Total Carbon	25.4 %	21.24 %	425
Carbon/Nitrogen Ratio (C/N)	11.6	11.6	
Total Nitrogen (Combustion)	2.04 %	1.705 %	34.1
Total Kjeldahl Nitrogen, %	2.20 %	1.836 %	36.7
Nitrate Nitrogen (NO3N)	0.01 %	0.009 %	0.2
Ammonium Nitrogen (NH4N)	0.22 %	0.181 %	3.6
Total Phosphorus %	0.99 %	0.826 %	16.5
Phosphorus as P2O5, %	2.26 %	1.892 %	37.8
Phosphorus as PO4-P, % (2% acetic Acid)	0.65 %	0.54 %	10.8
Phosphorus as P2O5, % (2% acetic Acid)	1.49 %	1.24 %	24.8
Total Potassium (K)	3.58 %	2.990 %	59.8
Potassium as K2O, %	4.31 %	3.600 %	72.0
Potassium, % (2% acetic Acid)	2.86 %	2.38 %	47.6
Potassium as K2O, % (2% acetic Acid)	3.44 %	2.87 %	57.4
Total Sulfur	0.76 %	0.640 %	12.8
Sulfur (SO4S) (2% acetic Acid)	0.40 %	0.34 %	6.8
Total Calcium	4.03 %	3.370 %	67.4
2% acetic acid soluble Calcium	3.32 %	2.77 %	55.4
Total Magnesium	0.82 %	0.690 %	13.8
Magnesium (Mg) (2% acetic Acid)	0.53 %	0.44 %	8.8
Total Sodium	1.29 %	1.080 %	21.6
Sodium (Na) (2% acetic Acid)	1.01 %	0.84 %	16.8
Zinc	491 ppm	410.00 ppm	0.82
Manganese (Mn)	336 ppm	281.00 ppm	0.56
Copper (Cu)	111 ppm	93.00 ppm	0.19
Boron (B)	27 ppm	22.00 ppm	0.04

Carbon Complexing





- Lower Use Rates
- Greater Efficiencies
- Humic

Biology

- Hormones
- Bio-Stimulants
- POX-C
- Bio-Fungicides
- Microbes
- Polyphenols
- The list goes on!

Biologicals

How do we make sense of it all ?

As a Potato Industry, what do we want to know more about?

How do we Prioritize research ?