



2.0

The Past, Current and Future Roles of Organic Amendments in Ontario Agriculture

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“This country is now entering an era in which the prevention of all waste is becoming more and more necessary and a nearer approach to self sustaining systems of agriculture are far more essential .

A clear understanding of the composition of farm manures, the changes it under goes and its avenues for loss and also methods for its practical handling and a realization of its effects both on soil and crops are of vital importance”

When was this written ?

**LH Bailey- Soils Their Properties and Management – 1915 - a 103 years ago
M.A. Schutt, Barnyard Manure losses Canadian Dept Agr. Centr Exp Farm
Bul 31 - 1898**

Current Nutrient Use

- No matter the source of nutrients either inorganic or organic the first step is to consider if you need nutrient applications to support production objectives
- Which nutrient?
- How much?
- Determined by a soil test
- Accredited methods
- Properly interpreted by knowledgeable people



Nutrients come from a variety of sources and there are many ways to apply them

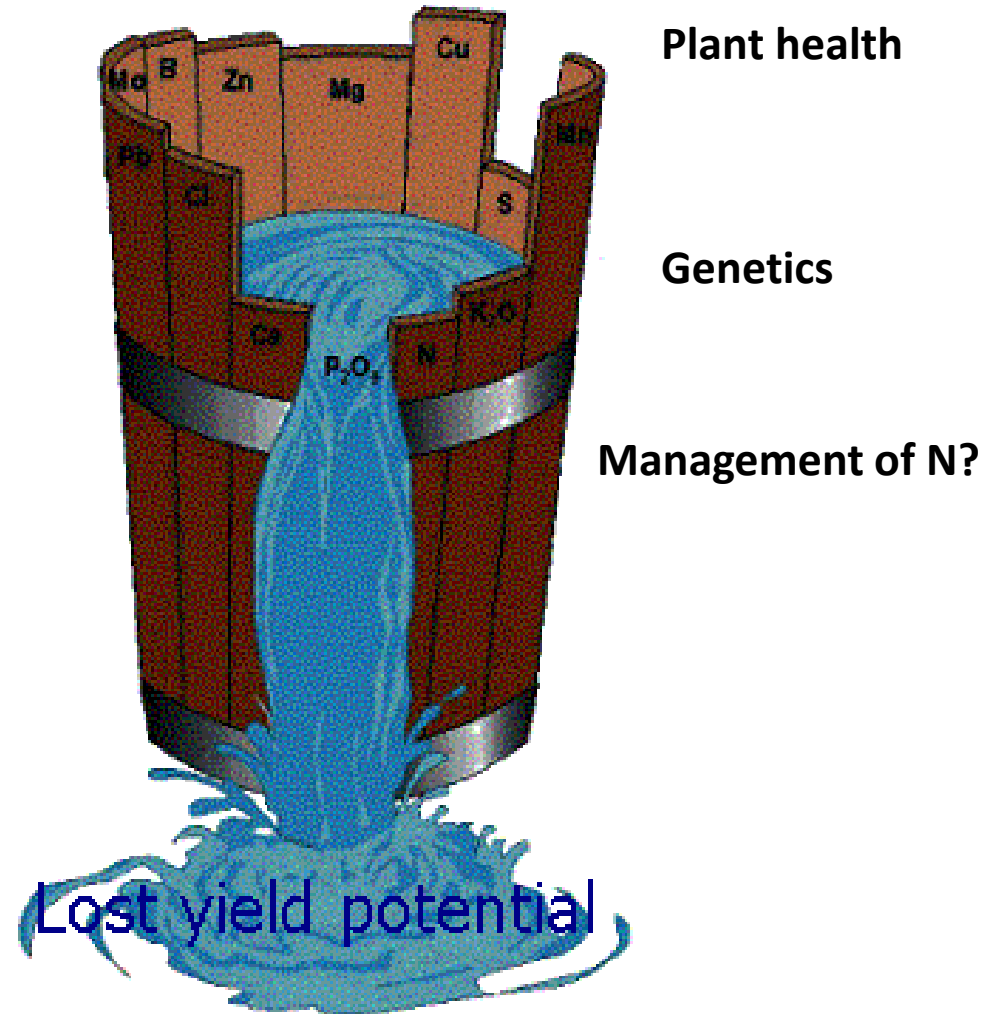


Von Liebig's Law of the Minimum

Yields are not determined by the total nutrient availablebut by the resource in the most limited supply

Yields can only be as high as the lowest stave in the barrel will allow... Soil testing measures the size and shape of the barrel of *"your"* soils

Plant population



What else needs to be added to the barrel ?

Soil Test

Sample date : October 22 2017

Sample ID	pH	BpH	OM%	P ppm	K ppm	Mg ppm	Ca ppm	CEC			
Field 1 A	7.0		3.1	15 MR	105 MR	205	2500	15.6			
Crop	Corn	Nutrient recommendation lbs / acre									
YG	185 bu	N	P ₂ O ₅	K ₂ O							
		180	20	50							

Is this nutrient recommendation a commercial fertilizer recommendation?



Lets start with a commercial fertilizer program for a 50 acre field applied in the spring

Product	Lbs / acre	N	P ₂ O ₅	K ₂ O	OM
Nutrient required		185	20	50	0
Urea	393	181			0
MAP	39	4.29	20		0
Potash	83			50	0
Total	515	185	20	50	0
Guaranteed %		35.9	3.9	9.7	0

50 acres requires a total amount of 11.68 MT or Two spreader loads cost per tonne is approx. \$552.00 / MT
 Or \$128.00 an acre plus application of \$12.00 = \$140 an acre all in
 Spread every 40 feet at 49 acres an hour I can be done in no time at all.

Lets start with a manure program for a 50 acre field applied in the spring

Product	Lbs / acre	N	P ₂ O ₅	K ₂ O	OC
Nutrient required		185	20	50	
Dairy solid	17156	16	20	62	1100
Red clover pd		55			
Urea	247	114			
Total	17360	185	20	62 (+12)	
Guaranteed %	17156 lbs	0.09	0.11	0.36	1100

Fertilizer cost is \$550.00 / te + application cost or \$73.00 an acre applied . Manure nutrient value is \$41.00 an acre plus \$4.00 per te to spread for a total spreader cost of \$31.00/ acre (need 390 te of manure) , Red clover credit is worth \$29 an acre All in cost is \$73.00 + \$31.00 + \$41.00- 29.00= \$116.00 an acre Without the red clover plow down it is \$18.00 an acre more than commercial fertilizer.

Systems Approach Comparisons

Commercial fertilizer	Cost values / acre	Combo system with Manure	Cost values/ acre
Fertilizer blend 35-3-9 @ 515 lbs per acre (11.7 te)	\$140.00 an acre	Manure application costs @ 7.7 MT/ acre (390 te)	\$31.00 an acre
Efficiency	Done in 2 hours	Manure nutrient value	\$41.00
		Urea (5.6 te)	\$73.00
		Red clover credit	(\$29.00)
		Efficiency	2 days?
Total Costs	\$140.00	Total cost	\$116.00

Important Note: I matched the nutrient requirements more or less precisely from the soil report which was used to determine the nutrients needed and their amounts. Surpluses of N and P were avoided.

Surpluses create an environmental issue not necessarily an economic issue!!

The Past

- In the past and even today in some cases (the past can be yesterday) but notably in the 1950s through to and 1980 s manure may not have been appreciated as much as it is today for it's nutrient and soil amendment contributions
- Certainly our agronomic knowledge and cropping systems are different today
- Equipment capacity/ calibration certainly was different then than now
- As result surpluses of nutrients built up in the soil beyond any reasonable crop need
- NMA brought nutrient management to the forefront - too bad it was tied to obtaining a building permit



Soil Test from Past practices

Sample date : September, 22 2017

Sample ID	pH	BpH	OM%	P ppm	K ppm	Mg ppm	Ca ppm	CEC				
Field 1 A	6.5	6.9	3.9	235	245	205	2900	18.0				
Crop	Corn	Nutrient recommendation lbs / acre										
YG	185 bu	N	P ₂ O ₅	K ₂ O								
		180	0	0								

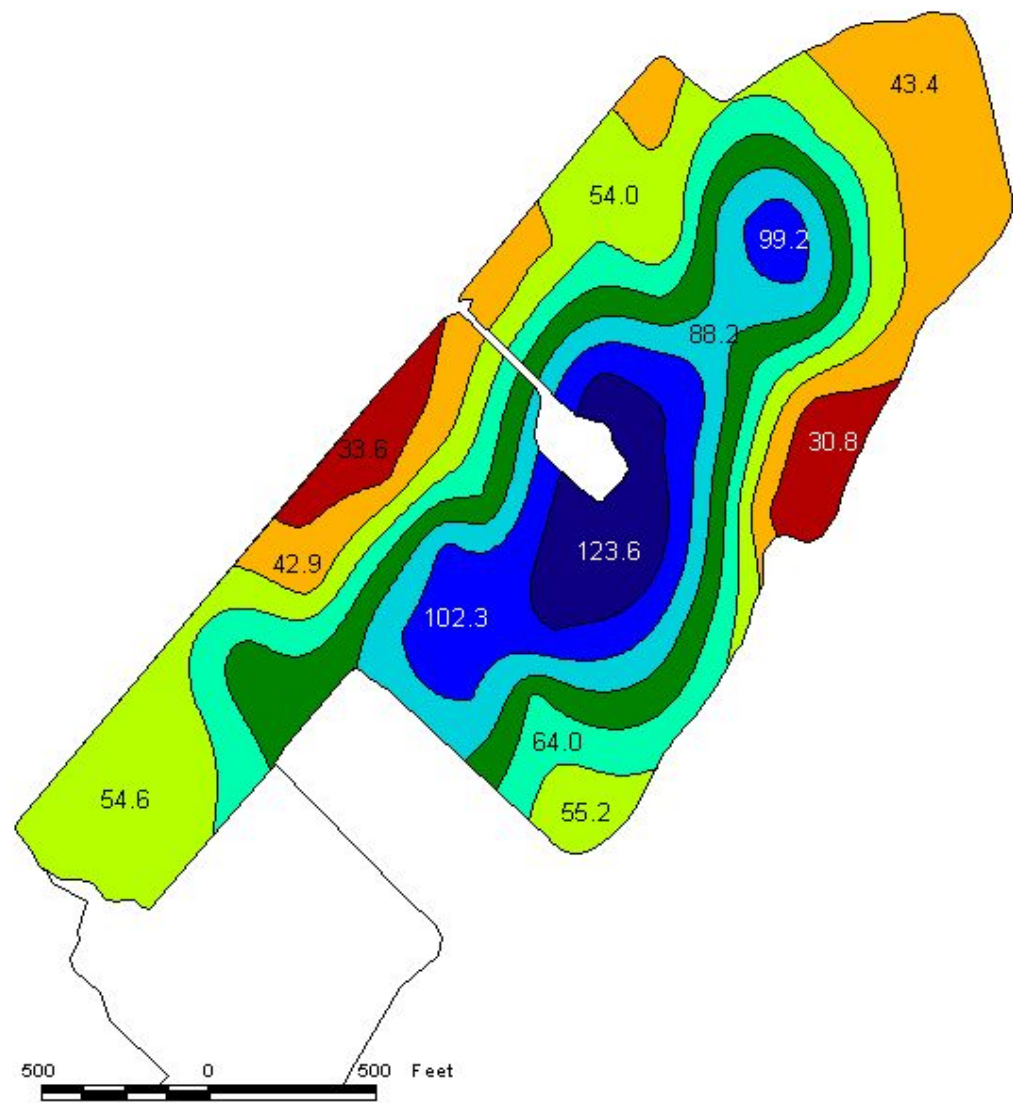
The only way for STP to increase is to apply nutrients at levels greater than crop removal

20 ppm P indicates optimum soil test P levels doubling to 40 does not double yields

35 lbs of P₂O₅ to raise or lower STP by 1 ppm

For **this legacy P** to be reduced to 20 ppm it will take removal of 7500 lbs of P₂O₅ or 81 years of 200 bushel corn, crop grain removal with no additional P sources added

Symptoms of inadequate storage – 90 days



Phosphorus Regions (ppm) 1997: P	
112.6 - 146.7	(4.5 ac.)
95.08 - 112.6	(7.9 ac.)
81.37 - 95.08	(9.1 ac.)
69.21 - 81.37	(10.1 ac.)
59.03 - 69.21	(11.0 ac.)
48.9 - 59.03	(18.6 ac.)
37.74 - 48.9	(13.0 ac.)
25.27 - 37.74	(4.3 ac.)
Field Boundary	

Date: Jul 24, 2001
Field Name: Beaver Meadow Hwy (01) #138063
Farm Name: Chimo Farms
Client Name: Chimo Farms Ltd.
Total Acres: 78.3
Field Boundary Start Location:
Latitude: 42.85652570
Longitude: -81.49556236
Minimum P: 30.8
Maximum P: 123.6
Weighted Average P: 67.95



Preferential Macropore Flow



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Surpluses

- It is not necessarily the source of materials that present any particular issue
- It is how they are used in a production system
- Both inorganic and organic source materials can cause environmental economic and social issues
- Choosing organic materials solely for building of soil carbon and discounting or dismissing nutrient content can lead to P loading and contamination of nitrates in ground water
- So to can inorganic materials if misapplied without good agronomy programs
- It is important to understand how surpluses can occur directly or inadvertently with normal practices as well as with poor management choices



Surpluses

- Nutrient surpluses can occur with all major elements independent of source materials, rates of application and timing for N, P and K
- We have a lot of focus on “P”, with P based NMS, NMP and NASMs
- Lets focus on Nitrogen
- Most eco systems on the planet have growth limited by nitrogen
- Commercial N fertilizer does increase soil microbial biomass it is not a bad thing if used appropriately
- It is an essential element – building blocks of life, amino acids and proteins
- It becomes a problem in the environment when supply exceeds needs



How do we get Surplus Nitrogen?

- You would think by now technology would have solved this issue
- But we deal with a biological system in the soil called the Nitrogen Cycle
- We have additions of N containing materials, transformations and losses driven by soil biology in turn driven by weather, temperature, moisture, modified by soil structure and crop residue materials, release of nutrients controlled by their C:N ratios
- We have on many occasions attempted to express the nitrogen cycle into formulas or charts or the ONC for simplicity and N rate decisions



N Rate determination is easy ?

- All we have to do is solve this equation

Nitrogen Rate = Nitrogen Needed – Nitrogen available



N Needs

- N needs are driven by yield potential
- Yield potential is driven by soil moisture

Moisture drives yield potential, yield potential drives nitrogen demand

- What yield potential do you have at the time when you make the decisions to apply nitrogen?
- 40 bushels of canola or 75 , 180 bushels of corn or 230
- At what time of the season is potential formed?
- What happens if applying N for 220 bushels and only get 180?



Nitrogen available how much and when?

- What nitrogen is available in my soil system?
- SOM release
- Crop residue release of organic N
- C:N ratios
- Mineralization
- Immobilization
- Losses
- Inorganic release
- Timing of crop peak needs

3% SOM is 60,000 lbs per acre it contains approximately
5% Nitrogen
Which is 3000 lbs of total organic N

2 to 5% may mineralize in a growing season giving a range
of plant available N of 60 to 150 lbs of N / acre

What actually is available depends on many factors ,
mainly weather



Temperature Influences on Nitrification

Temp	Days to 50% nitrate	100%
• 1C	190	380
• 5 C	38	76
• 10 C	19	38
• 15 C	13	26
• 20 C	10	20

We need a better mousetrap

- Half of problem solving is knowing there is an opportunity to pursue
- ONC, PSNT test have been good tools
- Weather based N models using accumulated rainfall at sidedress time to make adjustments is worth a look
- We need to increase our own awareness of the nutrient sources we use
- Increase our knowledge of their features and benefits and assess the risk on our own farms
- More on farm learning plots
- The more you look at your operation using science and evidenced based tools: the more you learn, the more you understand and the better decisions you make

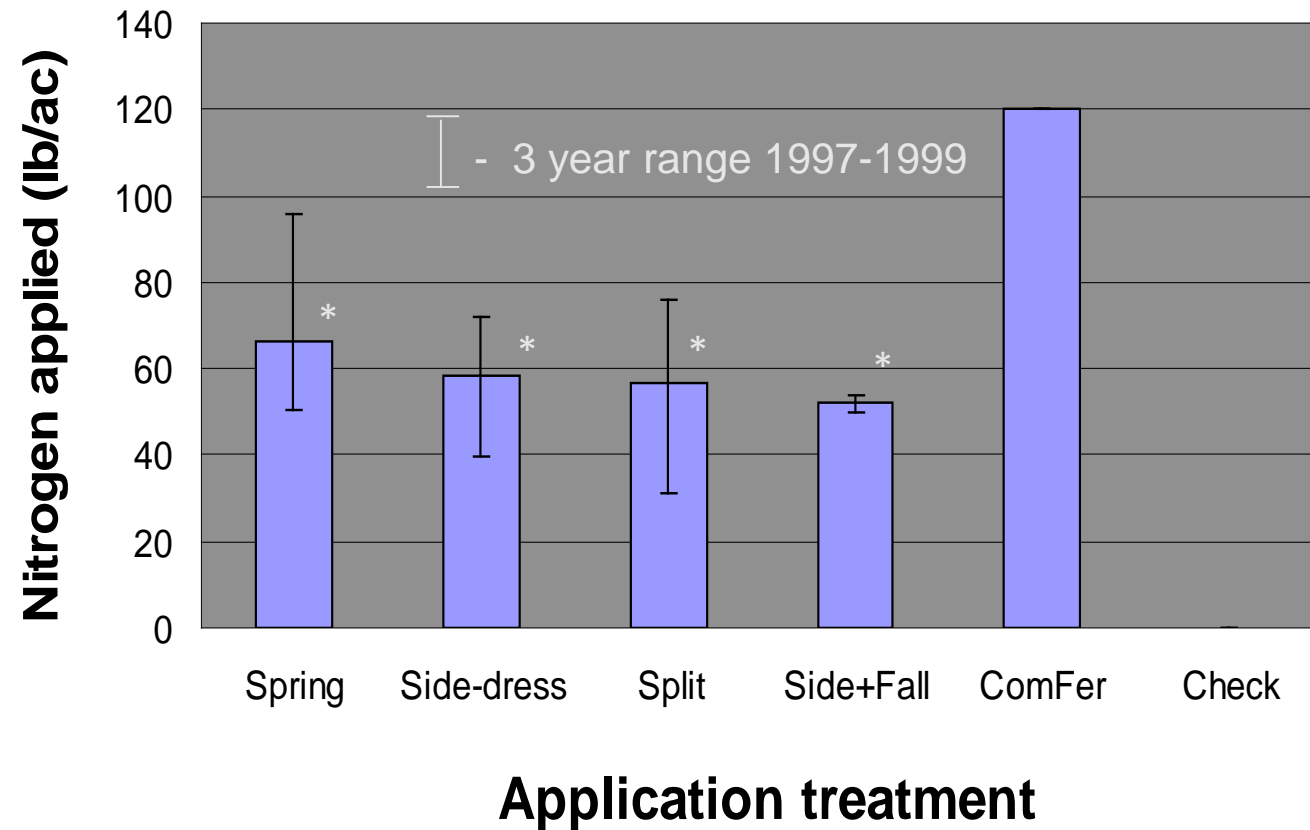


Future

- 4 R Stewardship , Right- Source, Rate, Time and place, easy to say but knowledge intensive to implement
- Choose your performance indicators you want to learn from
- Work with your 4 R Certified Retailer they will be required to account for all nutrient sources in a recommendation (most already do)
- Embrace the 4 R s not the 4 Ds- Defend, Deny, Delay and Duck
- Following 4 R is a choice
- Not following 4 R is a vote for regulation.



Comparison of nitrogen requirement



* based on soil NO₃-N test

Corn crop yield using manure management

