Soil Tests and Recommendations Accepted by the NRCS in Grower Assistance Programs

Chris Coreil

NRCS Conservation Agronomist

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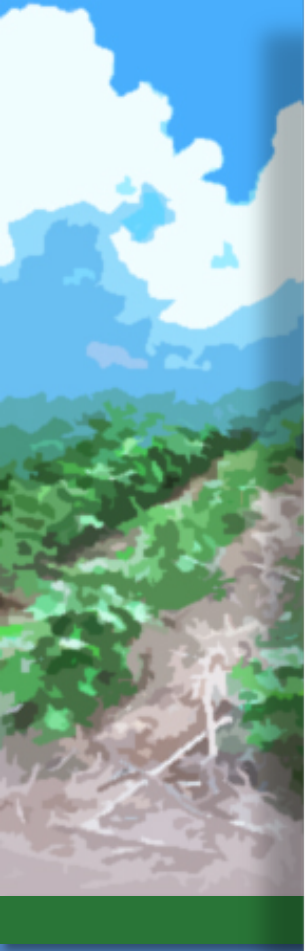
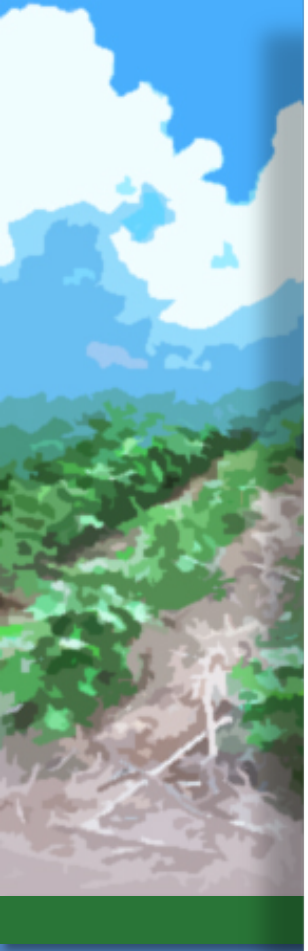


Nutrient Management

- To minimize agricultural non-point source pollution of surface and ground water resources
- To budget and supply nutrients for plant production
- To properly utilize manure or organic by-products as a plant nutrient source
- To maintain or improve the physical, chemical and biological condition of soil



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Nutrient Management

NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

CODE 590

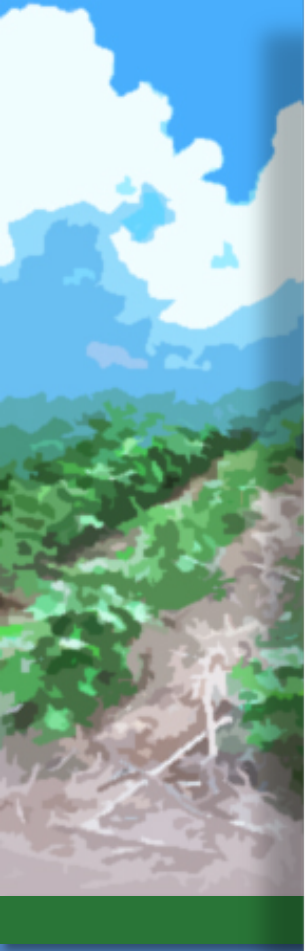
DEFINITION

Managing the amount (rate), source, placement (method of application), and timing of plant nutrients and soil amendments.

CRITERIA

General Criteria Applicable to All Purposes

A nutrient budget for nitrogen, phosphorus, and potassium must be developed that considers all potential sources of nutrients including, but not limited to, green manures, legumes, crop residues, compost, animal manure, organic by-products, biosolids, waste water, organic matter, soil biological activity, commercial fertilizer, and irrigation water.



Nutrient Management

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NUTRIENT MANAGEMENT

(Ac.)

CODE 590

Soil, Manure, and Tissue Sampling and Laboratory Analyses (Testing).

Nutrient planning must be based on current soil, manure, and (where used as supplemental information) tissue test results developed in accordance with land-grant university guidance, or industry practice, if recognized by the university.

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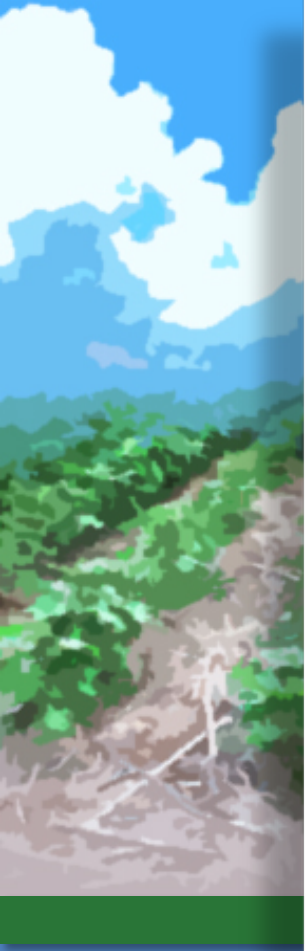

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CONSERVATION PRACTICE STANDARD

NUTRIENT MANAGEMENT

(Ac.)

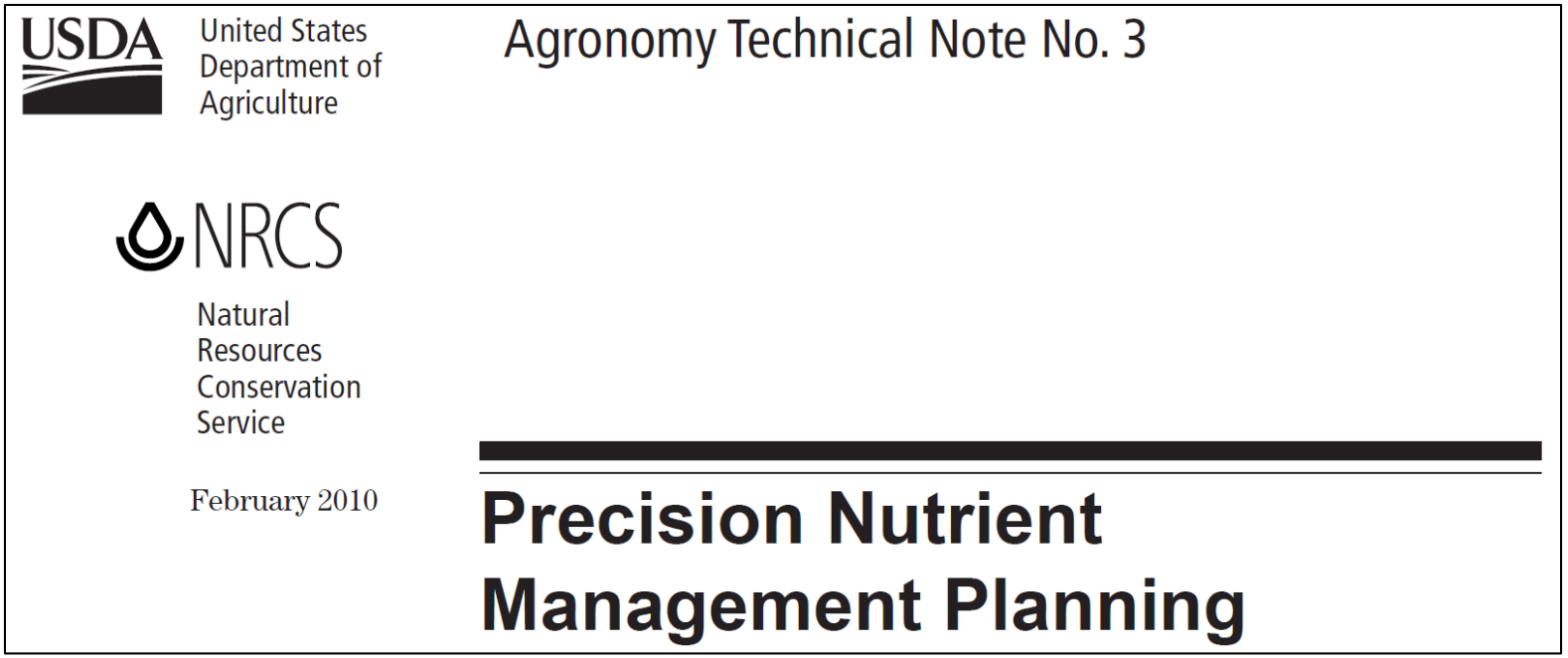
CODE 590

Nutrient Application Rates.

Planned nutrient application rates for nitrogen, phosphorus, and potassium must not exceed land-grant university guidelines or industry practice when recognized by the university.

Exceptions for the above criteria can be made for surface-applied manure when specified conditions are met and adequate conservation measures are installed to prevent the offsite delivery of nutrients. Th

Precision Nutrient Management



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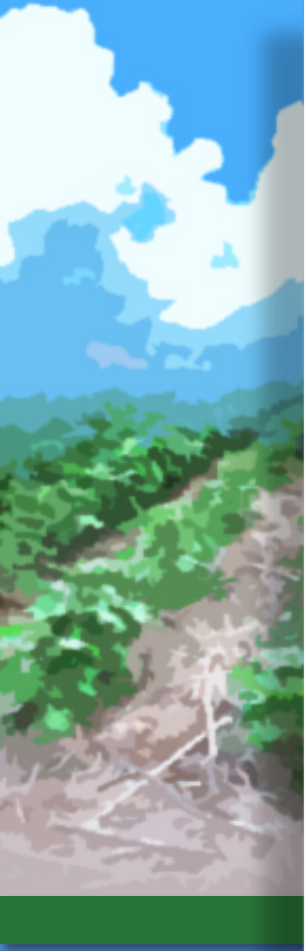
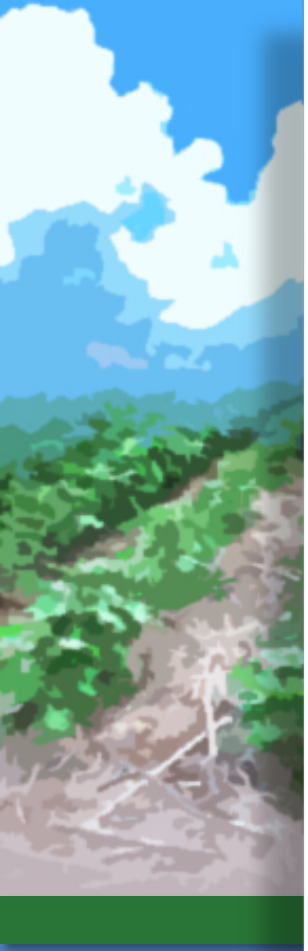


Precision Nutrient Management

- **Grid soil sampling** involves dividing a field into equal square or rectangular sections (grids) of several acres in size. The analysis from each grid sample is then used to establish zones based on one or several of the analysis results.
- **Electro-conductivity (EC) monitoring** determines measurable differences in soil texture, structure, organic matter, drainage, topsoil depth, soil water contents, and other soil characteristics. After collecting EC data, management zones are then determined based on an interpretation of differences in soil properties within the management unit along with layers of other applicable digital data, that is, digitized yield data, scouting reports, and soil survey layers. Soil sampling is required to correlate EC readings prior to setting the zones and application rates.



Nutrient Management and Soil Health Assessments

Benefits of improving soil health include…

- ✓ Improve water quality
- ✓ Regulate water and reduce flooding
- ✓ Cycle organic wastes and detoxify noxious chemicals
- ✓ Increase soil carbon and remove CO_2
- ✓ Save energy
- ✓ Save water and increase drought tolerance
- ✓ Increased infiltration and water holding capacity.
- ✓ Improve income sustainability
- ✓ Improve plant health and possibly improve nutrient-rich food production
- ✓ Improve wildlife habitat and estuarian food production
- ✓ Reduce disease and pest problems
- ✓ Reductions in sediment and nutrient delivery to surface waters decreases potential for downstream hypoxic zone formation

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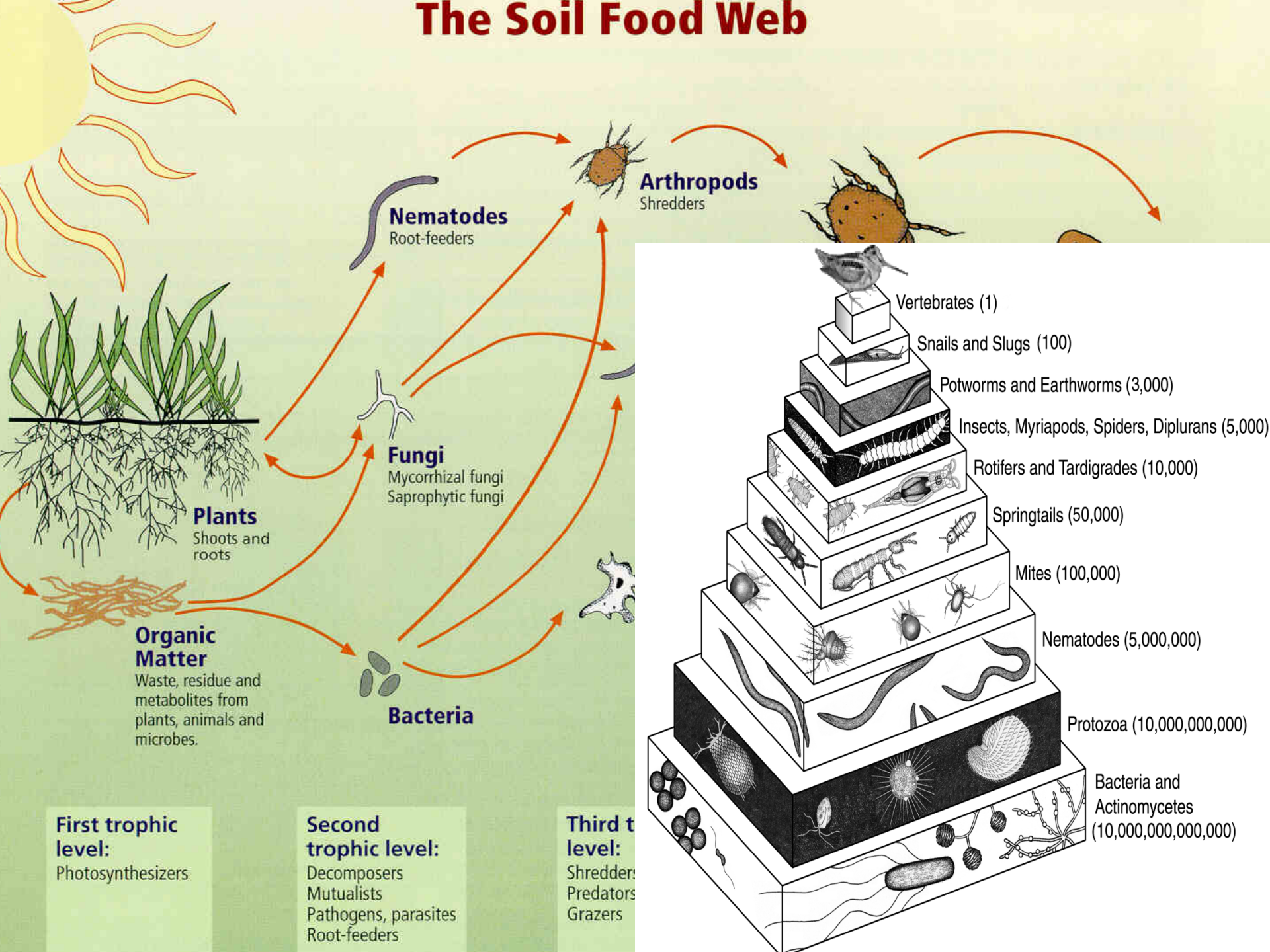
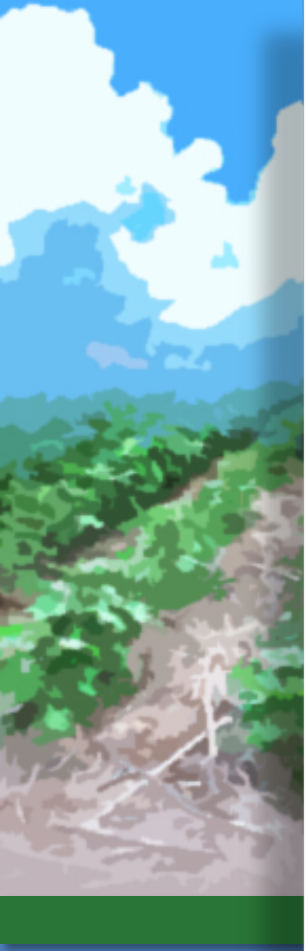
The Soil Food Web





Nutrient Management and Soil Health Assessments

- Soil ecosystem knowledge growing
- Assessments of the soil ecosystem and nutrient cycling improving
- Lab soil health analyses should be coupled with field measurements
- Two well recognized lab assessments promoted by NRCS:

  -ARS Soil Health Analysis (Haney Test) - https://www.youtube.com/watch?v=qQ3tI-KwgEE

  -Cornell Soil Health Analysis - https://www.youtube.com/watch?v=iiyKWb1FkIw

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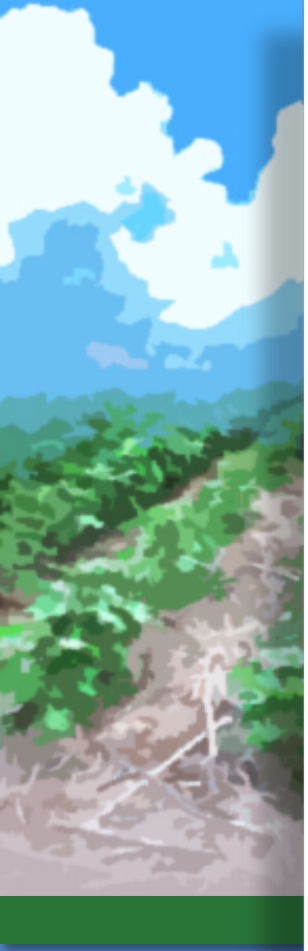

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Cornell Analysis

The Cornell Soil Health Analysis combines field measurements and lab results on a single page card:

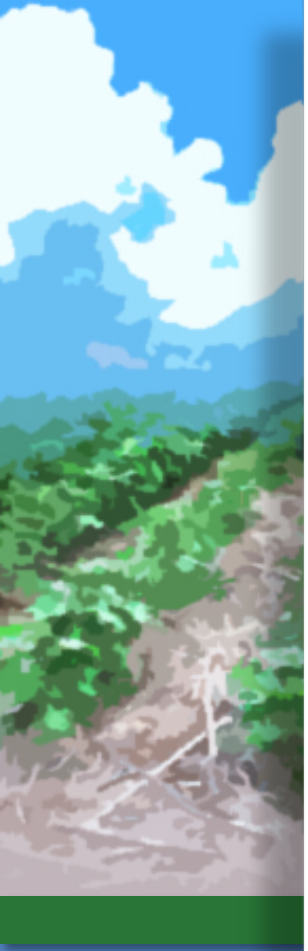
PHYSICAL	Available Water Capacity: reflects the quantity of water that a disturbed sample of soil can store for plant use. It is the difference between water stored at field capacity and at the wilting point, and is measured using pressure chambers.
	Surface Hardness: is a measure of the maximum soil surface (0 to 6 inch depth) penetration resistance (psi), or compaction, determined using a field penetrometer.
	Subsurface Hardness: is a measure of the maximum resistance (psi) encountered in the soil between 6 to 18 inch depths using a field penetrometer.
	Aggregate Stability: is a measure of how well soil aggregates resist disintegration when hit by rain drops. It is measured using a standardized simulated rainfall event on a sieve containing soil aggregates between 0.25 and 2.0 mm. The fraction of soil that remains on the sieve determines the percent aggregate stability.

https://soilhealth.cals.cornell.edu/

Cornell Analysis

The Cornell Soil Health Analysis combines field measurements and lab results on a single page card:

CHEMICAL	Soil Chemical Composition: a standard soil test analysis package measures levels of pH and plant nutrients. Measured levels are interpreted in this assessment's framework of sufficiency and excess but no crop specific recommendations are provided.
	Add-on Indicators: Salinity and Sodicity: Salinity is a measure of the soluble salt concentration in soil, and is measured via electrical conductivity. Sodicity is a calculation of the sodium absorption ratio (SAR) and is measured using ICP spectrometry to determine Na^{+}, Ca^{2+}, Mg^{2+} concentrations and using an equation to calculate the absorption ratio. Heavy Metals: is a measure of levels of metals of possible concern to human or plant health. They are measured by digesting the soil with concentrated acid at high temperature.



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BIOLOGICAL	Organic Matter: is a measure of all carbonaceous material that is derived from living organisms. The percent OM is determined by the mass of oven dried soil lost on combustion in a 500°C furnace.
	Soil Protein: is a measure of the fraction of the soil organic matter which contains much of the organically bound N. Microbial activity can mineralize this N and make it available for plant uptake. This is measured by extraction with a citrate buffer under high temperature and pressure.
	Soil Respiration: is a measure of the metabolic activity of the soil microbial community. It is measured by re-wetting air dried soil, and capturing and quantifying carbon dioxide (CO_2) produced.
	Active Carbon: is a measure of the small portion of the organic matter that can serve as an easily available food source for soil microbes, thus helping fuel and maintain a healthy soil food web. It is measured by quantifying potassium permanganate oxidation with a spectrophotometer.
	Add-on Indicators: Root Pathogen Pressure Rating: is a measure of the degree to which sensitive test-plant roots show symptoms of disease when grown in standardized conditions in assayed soil. Assessed by rating washed roots through visual inspection for disease symptoms. Potentially Mineralizable Nitrogen: is a combined measure of soil biological activity and substrate available to mineralize nitrogen to make it available to the plant. It is measured as the change in mineralized plant-available nitrogen present after a seven day anaerobic incubation.

Cornell Analysis

Cornell Soil Health Assessment

Jane Grower
Main St
Yourtown, NY, 12345

Agricultural Service Provider:
Schindelbeck, Bob
Ag Services
rrs3@cornell.edu

Sample ID: M_1
Field/Treatment: Veg field
Tillage: No Till
Crops Crown: COG, COG
Date Sampled: 3/2/2015
Given Soil Type: Lima
Given Soil Texture: Silt Loam
Coordinates: Coordinates Not Provided

Measured Soil Textural Class: Sandy Loam **Sand: 65%** **Silt: 26%** **Clay: 9%**

Test Results

	Indicator	Value	Rating	Constraint
Physical	Available Water Capacity	0.14	53	
Physical	Surface Hardness	240	22	Rooting, Water Transmission
Physical	Subsurface Hardness	310	53	
Physical	Aggregate Stability	56.6	47	
Biological	Organic Matter	3.3	55	
Biological	ACE Soil Protein Index	5.8	25	Organic Matter Quality, Organic N Storage, N Mineralization
Biological	Respiration	0.37	26	Soil Microbial Abundance and Activity
Biological	Active Carbon	366	28	Energy Source for Soil Biota
Chemical	pH	6.9	100	
Chemical	Phosphorus	7.5	100	
Chemical	Potassium	65.3	91	
Chemical	Minor Elements Mg: 213 Fe: 13.7 Mn: 7.8 Zn: 1.4		100	
	Overall Quality Score		58	Medium

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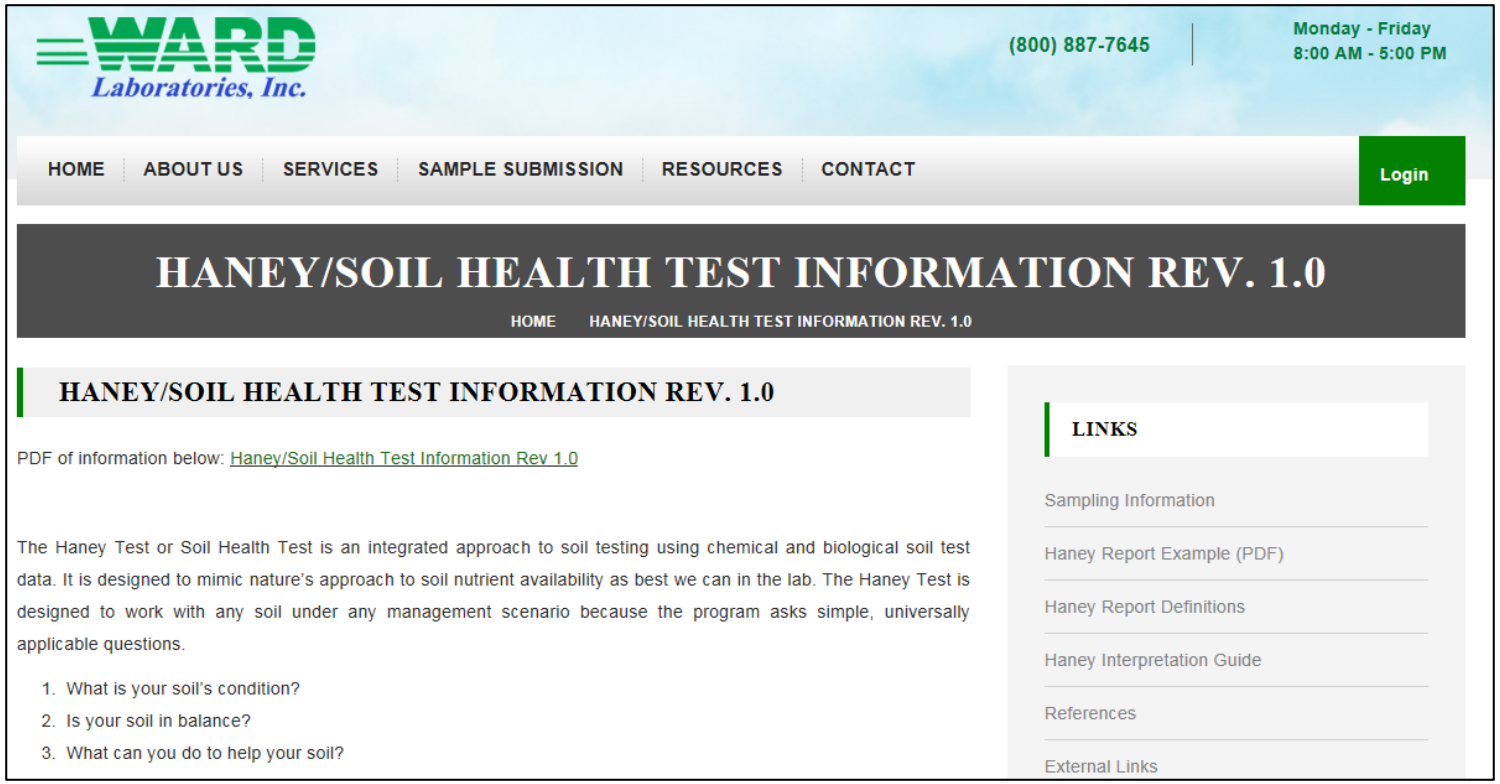
Haney Analysis

The Haney Soil Health Analysis does not require field inputs:



https://www.wardlab.com/haney-info.php

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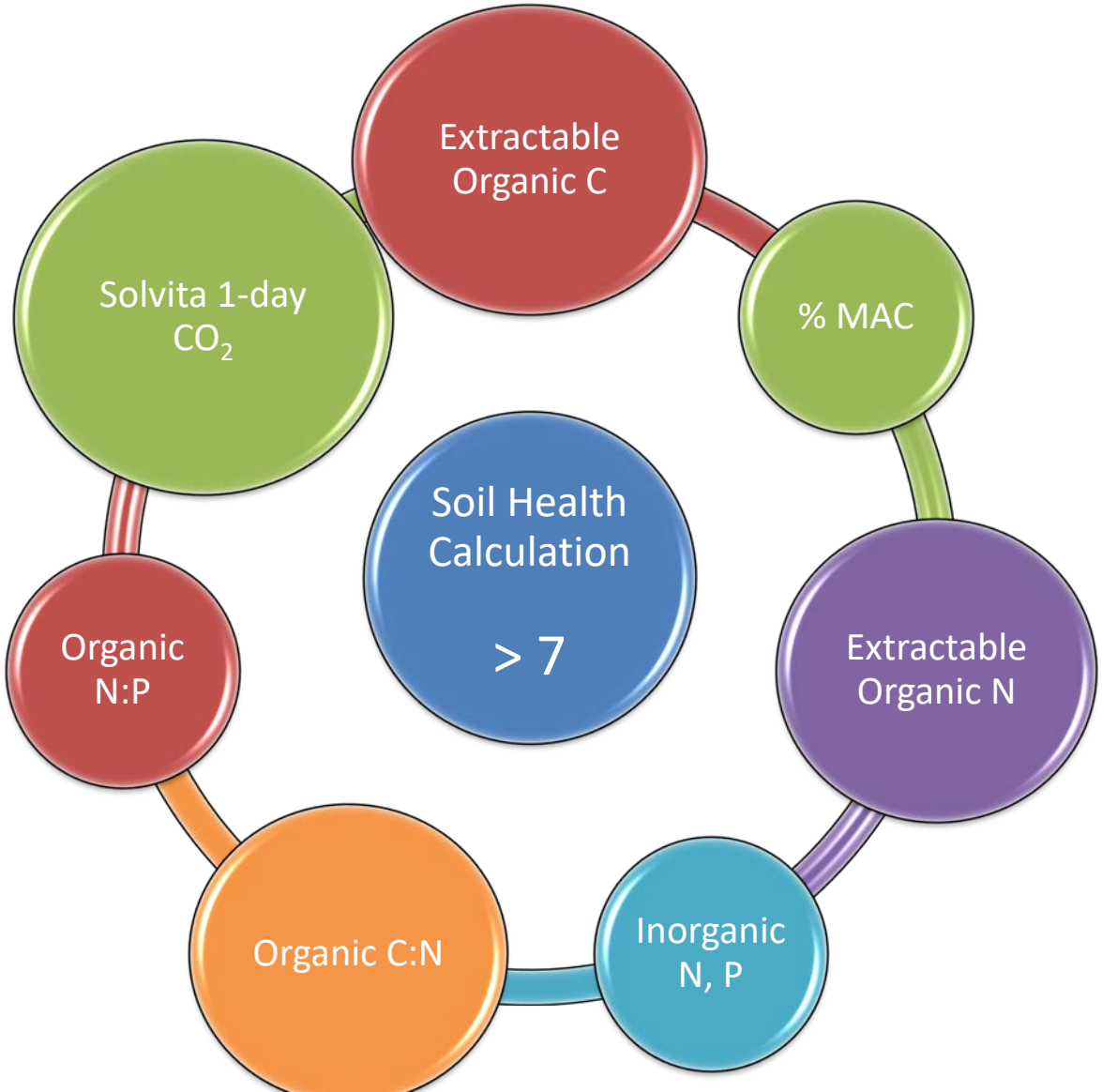
Haney Analysis



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Haney Analysis

LSU AgCenter Research & Extension

Soil Testing and Plant Analysis Laboratory
School of Plant, Environmental and Soil Sciences
Louisiana State University
Baton Rouge, LA 70803
Website: www.lsuagcenter.com/stpal

Soil Test Results

Coreil, Chris B
3737 Government Street
Alexandria, LA 71302

Rapides
chris.coreil@la.usda.gov

Date Received:	04/25/2017
Lab Number:	1217072001
Sample ID:	JeffD
Texture:	N/A
Area:	Alluvial
Irrigated:	No

Organic Matter Test

Element	Results
% Organic Matter	> 5.5

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Haney Analysis

Element (Mehlich3)	Value	Rice	Soybeans
pH (1:1 Water)	5.74	**Optimum**	**Low**
Phosphorus, ppm	32.59	**Medium**	**Medium**
Potassium, ppm	307.18	**Very High**	**Very High**
Calcium, ppm	4,126.51	**Very High**	**Very High**
Magnesium, ppm	1,302.94	**Very High**	**Very High**
Sodium, ppm	129.96	**Optimum**	**Optimum**
Sulfur, ppm	46.31	**High**	**High**
Copper, ppm	3.25	**High**	**High**
Zinc, ppm	4.65	**High**	**High**

RECOMMENDATION

Crop	Form	*Units: lb/Acre*	Nitrogen	Phosphate	Potash
rice			See Sheet	20	0

For additional crop information please see (http://www.stpal.lsu.edu/recsheets/C-150.rtf)

Crop	Form	*Units: lb/Acre*	Nitrogen	Phosphate	Potash	Expected pH / Acre with adding Lime 1 Ton
soybeans			0	30	0	6.35 Optimum

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Haney Analysis

	A	B	C	D	E	F
1			NPK in your soil			
2	Sample ID all lbs per acre >	Lab ID	N lbs per acre	P2O5 lbs per acre	K2O lbs per acre	Nutrient value per acre $
3	St.Martinville	LA-13286-R	93.3	34.2	81.4	$89.7
4						
5						
6						

	G	H	I	J	K	L
	Crop and Yield Goal Input			NPK you need to add		
		Crop	Yield Goal	lbs N needed	lbs P2O5 needed	lbs K2O needed
	Run	wheat	55	5.7	0	0

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Haney Analysis

Q	R	S	T	U	V
Soil Health Measurements					
1-day CO2-C	Organic C	Organic N	Organic C:N	Soil Health Calculation	Cover crop mix
323.7	302.5	24.0	12.6	28.7	20% Legume 80% Grass

W	X	Y	Z	AA	AB
Nitrogen Pools			Phosphate Pools		
Total Nitrogen lbs/acre	Inorganic N	Organic N	Total Phosphate lbs/acre	Inorganic P	Organic P
112.7	64.8	47.9	34.2	28.5	5.7

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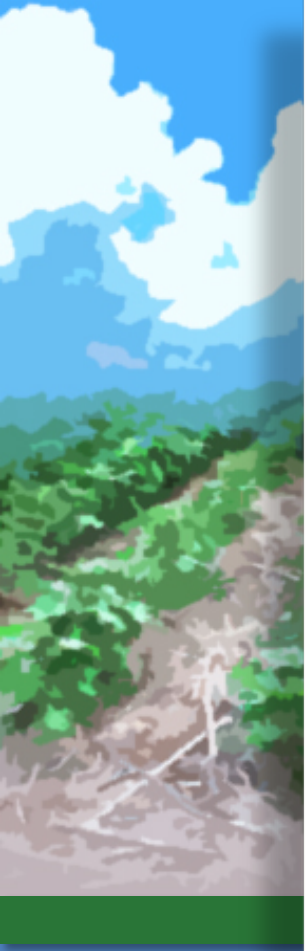

Haney Analysis

- Organic matter
- CO2-C soil respiration
- Water extract (organic) C:N
- % Microbially Active Carbon (MAC)
  - CO2-C/Total WEC
- Estimated N, P, and K for cash crop
- Recommended cover crop mix
- Soil Health Calculation
  - CO2-C/10 + Organic C/100 + Organic N/10

Haney Analysis

Results For : GULF COAST FLATWOODS
Sample ID 1 : CLEAR CREEK
Sample ID 2 : UNGRAZED

Haney - Soil Health Analysis

1:1 Soil pH	5.4	ICAP Sulfur, ppm S	8.0
1:1 Soluble Salts, mmho/cm	0.06	ICAP Calcium, ppm Ca	76.1
Excess Lime Rating	NONE	ICAP Magnesium, ppm Mg	27.9
Organic Matter, %LOI	3.3	ICAP Sodium, ppm Na	39.1
WDRF Buffer pH	6.5	ICAP Aluminum, ppm Al	306.3
Soil Respiration CO_2-C, ppm C	98.1	**Calculations**	
Water Extract		Microbially Active Carbon (%MAC)	49.9
Total Nitrogen, ppm N	14.5	Organic C : Organic N	38.4
Organic Nitrogen, ppm N	5.1	Organic N : Inorganic N	0.3
Total Organic Carbon, ppm C	197	Organic Nitrogen Release, ppm N	5.1
H3A Extract		Organic Nitrogen Reserve, ppm N	< 0.1
Nitrate, ppm NO_3-N	1.0	Organic Phosphorus Release, ppm P	2.5
Ammonium, ppm NH_4-N	17.6	Organic Phosphorus Reserve, ppm P	< 0.1
Inorganic Nitrogen, ppm N	18.6	**Soil Health**	
Total (ICAP) Phosphorus, ppm P	12	Soil Health Calculation	14.3
Inorganic (FIA) Phosphorus, ppm P	9.8	Cover Crop Suggestion	40% Legume 60% Grass
Organic Phosphorus, ppm P	2.5		
ICAP Potassium, ppm K	20		
ICAP Zinc, ppm Zn	0.6		
ICAP Iron, ppm Fe	180.5		
ICAP Manganese, ppm Mn	15.3		
ICAP Copper, ppm Cu	0.4		

Reviewed By : Nick Ward **8/16/2017** **Copy : 1** **Page 1 of 2**

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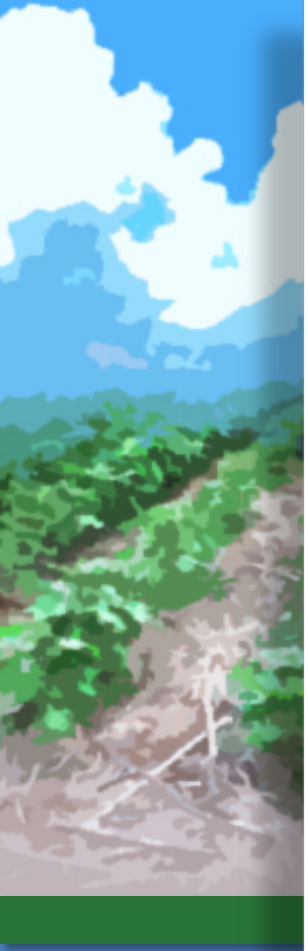

Soil Health Assessments and Conservation Stewardship Program (CStP)

- CStP = Stewardship payment for baseline + payments for Conservation Practices/Enhancements (activities) adopted.
- Enhancements do not reference a particular soil health assessment
- 2015 - SQL15 – no follow-up actions required
- 2016 – 2017 – E32810Z2 & E34010Z4 – management change required, but no nutrient adjustment.
- 2018 - E32810Z2 only

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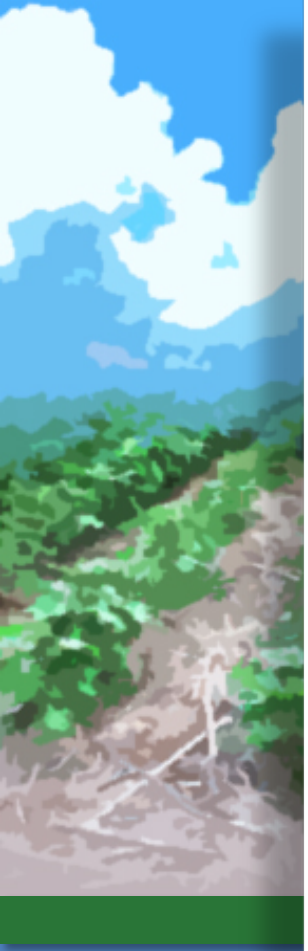

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