

## **NECC-1312 Annual Meeting Minutes, 10-3-17 Laurel Villa Inn, Milford PA**

Meeting called to order 1:07. Present Joel Tilley (VT), Bruce Hoskins (ME), Amy Shober (DE), Olivia Saunders (NH), Mike Rutzke (NY), Tracy Allen (MA), Stephanie Murphy (NJ) and Dawn Pettinelli (CT)

### **General Business:**

- Rick Rhodes – sent best wishes a reminder that we need to submit to NIMSS in writing for renewal of our coordinating committee sometime in this next year Request to be submitted to multistate activities committee who would submit our request for approval. Amy asked Karen Gartley (DEL) if she would do it and she agreed.
- Joel will retire in 9 months. Don Ross (VT) in about a year.
- Approved minutes. Amy made motion. Bruce seconded. Motion carried
- Officers: Dawn secretary and CT will host next year.

### **Websites:**

- Updates on website – chapter 4 & 8 sent to Karen by Bruce not published yet but Amy said to send to her and she will post.
- Discussed adding a table of wavelengths for routine analysis. Decided we should so send wavelengths and instrumentation for routine soil extracts to Bruce who will put into table for manual.
- Dawn will update appendix and send to Amy to post it.
- Amy will update NIMSS website with present members.

NECC-1312 potential new members - Agronomist Jarrod Miller from UDel, Soil Fertility Specialist Gurpal Toor – MD, Agronomist Charlie White Penn State (Doug's former position) Robert Schindelbech – head of Cornell Soil Health Lab, Eugenia Pena-Yewtukhiw (WV)

### **VT Nutrient Manual for Fertilizer Recommendations** – will be updated. (before Joel retires)

- Need updated recommendations since VT, starting to regulate golf courses as well as farms of a certain size.
- In DE, nutrient management plans needed for more than 10 acres of fertilized land and 8 number of animal units.
- Manure nutrient ranges vary, list on ME's website. Penn State probably has values for most types of manures.

### **P index**

- Revised by VT – no major changes but previous version released in 2006. Added tile drainage pathway which had dissolved surface erosion P loss and dissolved runoff P loss over surface – some comes out of tile drain outlet – problem where surface applied

manure and not incorporated, then reduces P index. How good is algorithm? Just starting to collect some data

- VT also had a selection of manure types but used to be weighted the same – now after some experiments with surface applied manure (almost all P in runoff) added biosolids and some others and now weighted differently. Experiments showed different manures did not reduce susceptibility to leaching of P
- Amy published in JEQ – looked at subsurface drainage piece. P index evaluated using load data – from ditches – don't know where exactly is coming from – used water extractable P and if high relative to seasonal water table, higher potential for P runoff. Ditch drainage – how to evaluate – based on soil hydraulic class
- In MD can get cut off from applying P due to subsurface or leaching piece. NRCS wants to use subsurface and leaching P. MD weighting fraction is the PSC (soluble P coefficient) EPA says to change their P index.
- DE law can go back to crop removal for P. Actually excess of chicken manure - bottom line is P from chicken manure not getting to farmers that need it because brokers don't want to move it that far plus when chicken producers want to get rid of manure it is winter and farmers don't want it yet.

### **Soil Health Testing**

- ME –field of soil health testing getting more crowded and confusing, there should be minimum number of parameters measured in northeast. When evaluating results, some soils will not fit into standardized interpretations so results should be regionalized if want a marketable testing system.
- NY – USDA/NRCS keep going back & forth on what kinds of tests. Really, it is field specific with 2 most important tests being aggregate stability & water holding capacity. Soil health testing is labor intensive and one needs lots of lab space and equipment so regional approach might be best. Maybe even field specific tests and interpretations. Different parameters for different soils in different areas. Other labs want to jump in but doing different tests than Cornell
- Soil health testing is a nice indicator to have but just needs to be done maybe every 5-10 years.
- Biodiversity good but how to monitor? Maybe bulk respiration but kind of funky? Is protein assay valid? Now looking at RNA sequencing to see what microbes present.
- Bioassay – bean test – look at roots after a month – seems quite useful (done in greenhouse – plant in cones) good indicator of disease.
- To measure respiration, what test is best –burst respiration or basal? 50% water filled pore space from top makes for more consistent results – Miller
- NY wicks up from air dry (ground & sieved soil), uses alkaline trap and measures conductivity from alkaline trap – reliable.
- ME - Solvita okay if done correctly. Need aggregates not fine powder because size affects water saturation.
- Soils vary so much regionally – i.e., DE mostly sand, no aggregates or water holding capacity but they irrigate so good yields. So soil health test would be not very helpful in this situation.

- NJ –attended meeting for soil health advisory group which summarized online survey from those involved in soil health testing. Listed 19 parameters of soil health. Also summarized methods being used. Problems with evaluations and interpretations.

#### 4 Important Parameters:

1. Respiration rate – either basal or burst
2. Permanganate oxidizable C – respiration C vs oxidational C
3. N release potential – like ISNT – many analysis
4. Aggregate stability

Conclusions: (ME & NY) There is a disconnect between the research end and the practical end. For the most part, researchers are not farmers and vice versa. The ones that were have mostly retired. The amount of organic matter and the soil pH are key variables for soil health. Soil health evaluations should be field and site adjusted. It was suggested to soil test regularly, monitor the organic matter and do a soil health test every 5 to 10 year. Farmers may expect soil health to change in a short period of time (2 years or so) but really make take 5 or 10.

SERA 17 was going to do a white paper on how soil health affects P. Have not gotten very far. Also, a letter to NRCS from joint groups was never written.

#### **University Support of Soil Labs (NJ)**

Rutgers – cost recovery, have to justify expenses, balanced for each unit, etc. At Rutgers, the Agricultural Experiment Station will not cover benefits anymore. Lab pays some salaries and benefits.

ME – lab has to pay for most salary and benefits (85 % +). Exp. Sta. input exchanged for free analysis for graduate students.

Some labs charge for graduate student samples & offer department members a discount.

Some labs do get state or federal funding and some funding from lab. Varies.

Equipment – some grants by multi-faculty for equipment. Occasional piece grant funded. Others funded from revenue from lab. Labs that do research goes up and down so good to rely on extension (home grounds samples) for more steady income. Some like Cornell have mechanism to save funds for new equipment. In DE, one private lab wants to close university lab down claiming competition.

Stephanie (NJ) wants to compile data from all of our labs showing amount of university support so she is asking we send her (no \$ amounts) but how our labs are funded, who pays what % of salaries & benefits. How costs of equipment are covered. She will send out a request.

**10/4/17**

#### **State Reports**

VT about the same as last year. Joel has been able to figure out how to put in some more tests into program,

CT – samples down, cold spring. Still working bugs out of Access soil test recommendation program. Still doing a lot of Extension work.

NH – numbers about the same, high tunnel samples about 117. They do research samples not separated in reports, clients get a report template with results, not just a link. Want to generate automatic reminder email for folks who have not submitted a sample in 3 years – need to figure out some logistics – mostly aimed to homeowners – in fall \$12 standard nutrient analysis & \$17 for nutrient analysis including OM. Database now cold fusion server because old one no longer supported. Samples go to Penn State

MA – up for particle size – demand from construction companies, SME's up, no more compost testing, looking into accepting credit cards and putting PSNT into our data system. Looking to how to replace some older equipment.

MD – \$12 commercial. \$15 homeowner, all tested for lead, \$10 researcher – Joe Pauler is new lab coordinator, CN analyzer broke so samples sent to Penn State, looking to purchase new one. Renovations in 2018 but where will lab go? Joined up with water analysis program, also soil characterization lab. Research – Amy – cover crops, how water flowing in ditch system to understand movement of P in field. Equal distribution of applying poultry litter – needs to go where it is needed. Anyone who applies fertilizer commercially in Del has to be certified. Amy does trainings.

NY – Cornell mostly research, BOX spreadsheet program so can tract sample numbers. Surplus budget for last 4 years – no more debt – now soil health lab on its feet and now separated from SNL. Both manage own finances (3000 samples to soil health lab last year). Sample volume somewhat stabilized annually. Lots of R & D & innovation. Plant sap analysis test – used to analyze calcium in apples for bitter bit. Phenotyping research for element uptake, want to get an ICP-MS,

ME –calendar year, 2016 record year, 17,000 samples from ME, VT, NY, 500 greenhouse/high tunnel samples, 500 forest soil samples – national park service& forest service research facilities, CO2 burst tests – (nearly 700) highly popular soil biology test. (the Solvita ammonia test (SLAN) has about = results to ISNT) 800 plant samples, 550 petiole, 500 manure samples 125 composts, 4200 prepped samples, 800 combustion samples. Several research projects – several multistate.

### **Hi P & Homeowner Samples**

- What should we do when P and also Om way too high - ? Some of us comment, MA has a fact sheet on (distributed).
- ME sees if too much compost, then not enough nitrate available so N deficiency because N release is too slow to meet plant needs. Can be important issue because of overapplication of compost and P.

### **Marijuana**

- What to do with samples – just the media testing but can't take plant samples or plant disease samples.

## Sulfur

- Amy – Quirine, Josh & John info – S concentration decrease in soil over time because of reduced emissions. M3 track trends over time but not necessarily related to plant response – sandy low OM soils most susceptible.
- Other reasons aside from emissions – not enough mineralization from subsoil, weathering, etc.
- Symptoms look similar as N deficiency – but chlorosis in newer tissue growth for S, not older like N, also poor root growth, chlorotic, stunted – for small grains and corn.
- Can use ammonium sulfate but deficiency really shows up where no manure used. Tissue sample for confirmation but too late in season to do anything.
- NY - Sap testing might be good – get 1.5 to 2 mm sap if frozen and squeezed (S .16% is low – probably total wet ash) squeeze with garlic press
- 15: 1 N: S = normal 28:1 shows S deficiency
- Calcium sulfate soil test also does not measure organic sulfur but does correlate with plt response
- 180 line has a calcium interference on it – use 182 line (can't dry ash S as goes off as gas)
- Soil sample collection for S would have probably to take deeper sample. Soils with adequate amounts of organic matter would likely not have S deficiencies.
- General recommendation of 20-40 lbs S/A and 25 -35 lbs S/A applied for grains if known S deficiency fields – S applied in previous years does not carry over
- Elemental sulfur, ammonium sulfate, gypsum,  $K_2SO_4$ , Sul-Po-Mag, Aluminum Sulfate & manures are common S fertilizers

Next year meeting – Oct 11 & 12, 2018

Respectfully submitted,  
Dawn Pettinelli

**STATE REPORTS 2017**

**NECC-1312 Annual State Report For Connecticut**  
 Reported July 2016 for period: Calendar 2015

<b>Contact</b>	Thomas Morris	Dawn Pettinelli
<b>Mailing address</b>	1376 Storrs Rd U4067 Univ. of CT Storrs, CT 06269	UConn Soil Nutrient Analysis Lab 6 Sherman Place U5102 Storrs, CT 06269
<b>Phone number</b>	860.486.0637	860.486.4274
<b>FAX number</b>	860.486.0682	860.486.4562
<b>e-mail address</b>	<a href="mailto:THOMAS.MORRIS@UCONN.EDU">THOMAS.MORRIS@UCONN.EDU</a>	<a href="mailto:DAWN.PETTINELLI@UCONN.EDU">DAWN.PETTINELLI@UCONN.EDU</a>
<b>Website address</b>	<a href="http://www.soiltest.uconn.edu">www.soiltest.uconn.edu</a>	

**Lab personnel FTE's:** 2 + ½ Special Payroll (11 months) + Student Labor

**Extractant(s):** Modified Morgan for mineral soils, water for SME for greenhouse soils,

**Instrumentation:** Spectro Ciros Vision ICP, Unity Westco Smart Chem 170 Discrete Analyze for ortho-phosphate and nitrogen-nitrogen, nitrate electrode for tissue NO<sub>3</sub>-N (Cornstalks), Elementar VarioMax

**Cost for routine test:** \$12

**Routine test includes:** pH, Ca, Mg, K, P, Mn, Cu, Zn, Fe, Al, B, estimated total lead, estimated CEC, % BS & modified Mehlich buffer pH.

**Sample Summary:**

Category	Soil	SME	Plant
<b>Total Samples</b>	8554	158	1134
<b>Commercial MM</b>	918		
<b>Homeowner MM</b>	4578		
<b>Dept Research MM</b>	342		
<b>Nitrate/PSNT</b>	1075		
<b>Teaching</b>			
<b>Misc – OM, Tex, SS, pH</b>	1619		
<b>Cornstalk NO<sub>3</sub></b>			334
<b>Total N – Elementar</b>	22		389
<b>ICP Plant Tissue</b>			411

**Summary of Research:**

Soil and tissue testing for N in turf. Spatial variation of soil chemical and biological tests on manured fields. Leaching of P where compost applied to turf.

**Other/News:**

Soil sample numbers down but price went up so revenue about the same. Cold spring.

Master Composter program offered in October 2017

Still working out a few kinks in new Access soil test recommendation program.

Purchased a new muffle furnace with 3 shelves.

# NECC-1312 Annual State Report for Maine

reported October, 2017

(sample numbers for calendar 2016)

**Contact:** Bruce Hoskins  
**Address:** 5722 Deering Hall  
Orono ME 04469

**Voice:** 207-581-2945

**Fax:** 207-581-3597

**Email:** hoskins@maine.edu

**Web site:** anlab.umesci.maine.edu

**Lab personnel FTE's:** 4.5 technical, 2 professional, 1 IT/Administrative

**Extractant(s):** modified Morgan (ME, VT); Morgan (NY); NH<sub>4</sub>Cl (forest soils), others on request

**Instrumentation:** TJA iCAP-6300 ICP's, OI Analytic & Lachat Ion Analyzers, Labfit pH system,

Leco Tru-Mac combustion analyzers, AIM600 Kjeldahl block digester

Dionex ICS-1000 Ion chromatograph, CEM MDS-2100 microwave system, PE FIMS-100 Hg analyzer

**Cost for routine test:** \$15 (\$12 during winter), \$22 with NH<sub>4</sub>/NO<sub>3</sub> (Comprehensive test)

**Routine test includes:** pH, LR (mod Mehlich), OM, P, K, Mg, Ca, S, B, Cu, Fe, Mn, Zn; Na, Pb screen

## Sample Number Summary (for calendar 2016)

	ME+VT+NY		ME+VT+NY			Other	Prepped for instrument
	Soil	Plant	Manure	Compost	Metals		
Commercial	13700	800	490	125	195	235	1900 ICP
Homeowner	4990					(lime/fert)	2300 FIA
Research	320	250					780 TN/TC
NO <sub>3</sub> /PSNT	495 GH/HT	550 pet.					
Other	460 FS						
	680 Solvita						
	250 PSI						

## Summary of Research

Organic bread wheat production - collaborative w/ VT (continuing grant).

Nutrient and Pest Mgt in High tunnel production (MM & SME) + IPM - year 2 of 3 yr SARE grant.

Organic Vegetable production systems (weed control & rotation strategies) 3 yr OREI grant.

Permanent Bed production system project (OREI)

Weed control strategies in vegetable production.

## News/Other

Continued characterization N-min rates and secondary/micronutrient content of non-chemical fertilizers.

Lab continues with small fixed Exp. Sta. input for Grad project samples (short proposal required).

Evaluating Soil Health/SoilQuality Test Package enhancements - SLAN, POXC

Subcontracting from several private labs for combustion, lime eq., fertilizer methods.



**NECC-1312 Annual State Report for Massachusetts  
Reported September 2017 for period: FY17**

<b>Contact</b>	Tracy Allen, Lab Supervisor
<b>Mailing Address</b>	UMass Soil & Plant Nutrient Testing Lab 106 Paige Laboratory 161 Holdsworth Way Amherst, MA 01003
<b>Phone Number</b>	413-545-2311 / 413-545-5304
<b>Fax Number</b>	413-577-0242
<b>Email address</b>	<a href="mailto:soiltest@umass.edu">soiltest@umass.edu</a> ; <a href="mailto:tall@umext.umass.edu">tall@umext.umass.edu</a>
<b>Website address</b>	<a href="http://ag.umass.edu/services/soil-plant-nutrient-testing-laboratory">http://ag.umass.edu/services/soil-plant-nutrient-testing-laboratory</a> (Also redirects from <a href="http://soiltest.umass.edu">soiltest.umass.edu</a> )

**Lab Personnel FTEs:** 4.7 + Student Labor

**Extractant:** Modified Morgan for mineral soils, water for SME greenhouse media

**Instrumentation:** Spectro Blue, Spectro Ciros, Lachat QuikChem Series 2, Elementar VarioMax, Environmental Express AutoBlock

**Cost for routine test:** \$15

**Routine test includes:** pH, Exchangeable Acidity, Extractable Nutrients P, K, Ca, Mg, Fe, Mn, Zn, Cu, B, S, plus Al and Pb, CEC, Base Saturation, Crop-specific lime and fertilizer recommendations

**Sample Summary:**

Category	Soil	SME	Plant	Compost
Total Samples	18707	363	917	116
Routine	16731		489	
PSNT	206			
Particle Size Analysis	1133			
Total Sorbed Metals	452			
Miscellaneous	185		428	

**Research:** Collected data from about 400 Samples run as Total Sorbed Metals Tests as well as Routine Soil Tests plus Organic Matter. We are looking at Modified Morgan Extractable Lead, Total Lead (as measured via EPA 3050B), state of origin, pH, and Organic Matter percentage.

**Other Information:**

- We discontinued our Compost program in January 2017 due to difficulties with quality control, proper equipment, inadequate staffing, space, and funding issues.
- We have been marketing our Prepaid Kits to landscaping companies and other green industry professionals (as well as a few local farms) in an attempt to increase volume.

**Current and Future Projects:**

- Set up a system for credit card payment using UMass Extension Bookstore website for lab services
- Add a module to our SoilTest Program for PSNT data collection and report generation (We currently use Microsoft Word and Excel to generate reports.)
- Investigate test methodology and reporting for hoop house soils

# NECC-1312 Annual State Report Form

State: New Hampshire  
 Year: 2016

Contact: Olivia Saunders  
 Mailing address: PO Box 1480  
 Conway, NH 03818

voice: (603) 447-3834  
 email: [Olivia.saunders@unh.edu](mailto:Olivia.saunders@unh.edu)  
 web site: [extension.unh.edu](http://extension.unh.edu)

Lab personnel FTE's:

Extractant(s):

Instrumentation:

Cost for routine \$17

Routine test incl Extractable calcium, magnesium, potassium, phosphorus, soil pH, organic matter content, and a lead screening analysis. Both conventional and organic fertilizer recs are given

## Sample Number Summary (change categories as needed)

	Soil	Plant	Manure	Compost	Water			
Total	3605			22				
Commercial	1400							
Homeowner	2193							
Research								
NO3/PSNT								
Other (christmas	12							

Jan 1, 2016-Dec 31, 2016 = samples

## Summary of Research

# Cornell Nutrient Analytical Lab NECC 2017 Annual State Report 2017

Cornell Nutrient analytical lab (CNAL) can report that it is now operating with a surplus budget. We analyzed a total of about 26,679 samples from July 1<sup>st</sup> 2016 June 30<sup>th</sup> 2017. Most of these samples analyzed would be classified as research samples and most of these samples were submitted from outside Cornell.

It is Cornell's policy that CNAL is primarily a research analytical facility, and is prohibited to analyze grower service samples or send out recommendations to growers if the service are provided by a commercial lab. We can analyze grower's samples if the analysis we provide is not available commercially.

We analyzed about 3,488 Soil health samples which includes basic soil fertility. An additional 600 samples were analyzed for basic soil fertility. We analyzed about 6,000 plant samples. We also analyzed about 2,000 water samples.

The remainder of the other samples analyzed were for the many other analytical tests we offer. See our website <http://cnal.cals.cornell.edu>

Michael A. Rutzke, Ph.D  
Director of the College of Agriculture and Life Sciences Nutrient Analysis Lab.  
803 Bradfield  
306 Tower Road  
Cornell University  
Ithaca NY 14853  
[mar9@cornell.edu](mailto:mar9@cornell.edu)

## NECC-1312 Annual State Report Form

State: Vermont  
 Year: reported October 3, 2017, for period July 1, 2016, to June 30, 2017

Contact: Joel Tilley or Don Ross  
 Mailing address: UVM Agricultural & Environmental Testing Lab  
 Room 262 Jeffords Hall, 63 Carrigan Dr  
 Burlington, VT 05405-1737  
 voice: 802-656-3030  
 fax: 802-656-4656  
 email: agtesting@uvm.edu  
 web site: [http://pss.uvm.edu/ag\\_testing/](http://pss.uvm.edu/ag_testing/)  
[http://www.uvm.edu/pss/ag\\_testing/](http://www.uvm.edu/pss/ag_testing/)  
 Lab personnel FTEs: 1.0 plus various work-study students and interns

Extractant(s): Modified Morgan

Instrumentation: Perkin Elmer Optima 3000 DV ICP  
 Lachat QuikChem 8000  
 Thermo FlashEA NC Soil  
 Dionex Ion chromatograph, ED-50 conductivity detector (AS14A column, anions)  
 CEM MARS-5 microwave

Cost for routine test: \$14 (add \$2 for add'l crop recs; add \$10 for heavy metals)  
 Routine test includes: pH, OM, P, Ca, Mg, K, Na, Al, Fe, Mn, Cu, Zn, S; est CEC, BS; recs for one crop

### Sample Number Summary (change categories as needed)

	Soil	Tissue (Plant, feces, yogurt, ...)	Manure	Compost	PSNT / Soil NO3	Metals	SME	Maple syrup / sap	CN	Stream water & Runoff	Particle size analysis
Farm	3357		243	1	678						
Commercial Fruit & Veg	706				1		1				7
Homeowner	799					40					
Research + class projects	560	277			1865	217			320	5438	
<b>TOTAL</b>	<b>6,422</b>	<b>277</b>	<b>243</b>	<b>1</b>	<b>2,544</b>	<b>217</b>	<b>1</b>	<b>-</b>	<b>320</b>	<b>5,438</b>	<b>7</b>

\* Soil, manure, and compost samples run at UMaine lab

### Summary of Research

Agricultural Practice Monitoring and Evaluation. AGO NRCS

Phosphorus export and speciation from the tile drained agricultural soils of Vermont's Lake Champlain Basin (Hatch)

Lake Champlain Basin Resilience to Extreme Events (NSF EPSCoR)

Phosphorus export from forested watersheds in the Missisquoi Basin (USGS Water Center)

### News/Other

New soil test reporting software implemented October 15, 2015; upgraded in past year to accommodate manure, soil metals, and other miscellaneous reports.

## NECC-1012 Annual State Report Form

State: Pennsylvania  
Year: 2016

Contact: John Spargo	Doug Beegle
Mailing address: 111 Tower Rd	116 ASI Building
Penn State University	Penn State University
University Park, PA 16802	University Park, PA 16802

voice: 814/865-9155	814/863-1016
email: <a href="mailto:jts29@psu.edu">jts29@psu.edu</a>	<a href="mailto:dbb@psu.edu">dbb@psu.edu</a>
web site: <a href="http://www.aasl.psu.edu">www.aasl.psu.edu</a>	<a href="http://extension.psu.edu/plants/nutrient-management">http://extension.psu.edu/plants/nutrient-management</a>

Lab personnel FTE's: 11

Extractant(s): Mehlich 3, Modified Mehlich Buffer

Instrumentation: 2 Varion 730-ES ICP; 2 Labfit AS-3010D automated pH analyzers  
2 Elementar VarioMax C/N analyzers, 1 Elementar Cube, 1 Timberline

Cost for routine test: \$9  
Routine test includes: pH, acidity, P, K, Mg, Ca, (+ Zn, Cu, S for agron crops), CEC (sumation)

### Sample Number Summary (change categories as needed)

FY15

	Soil	Plant	Manure	Compost	Metals	Biosolids	Water	Greenroof
Total	47430	7000	700	700	500	650	2000	500
Commercial								
Homeowner								
Research		5500						
NO3/PSNT	500							
Other								

### Summary of Research

NESARE Dairy Cropping Systems Project – Interdisciplinary whole farm dairy cropping systems project with a significant soil testing and nutrient management component. Also includes weeds, insects, cover crops, diverse rotations, mycorrhizae, canola for tractor fuel, and a virtual dairy herd. Field scale lysimeters have been constructed on a location within this experiment to evaluate specific segments of the whole management farm system for N and P loss.

Soil Sampling for PSNT with Injected Manure – Studying how to sample to capture the effects of injected manure in PSNT soil test results.

Chesapeake Bay Regional P Index Project – Using field data and models to improve the P Index.

Fertilizer Forecaster Project - Developing web based decision support tools for timing fertilizer application using high resolution mapping and weather data.

Evaluation of mine drainage residuals to reduce water soluble P and P runoff from surface applied manure - Developing lab methods to quantify efficacy of MDR to reduce manure WSP (dose response and reaction kinetics); evaluating impact on runoff P losses from surface application of treated manure. Collaboration among Penn State, ARS, and Iron Oxide Recovery/Hedin Environmental

Recovery of total soil phosphorus: manure digestion study - Evaluating modification of several standard digestion methods for recovery of total soil P (e.g., EPA 3050B, EPA 3051, EPA 3052). Collaboration among Penn State and ARS

Sulfur response - Sulfur response experiments on corn at 30 locations across PA.