Northwest Biosolids Management Association

Fertilizing with Biosolids

Dan M. Sullivan
Craig G. Cogger

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OSU
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College of Agricultural Sciences

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Fertilizing with Biosolids

Table 1. Biosolids organic matter and macronutrients (dry weight basis).[a]

	Usual range (%)[b]	
Nutrient	**Low**	**High**
Organic matter	45	70
Nitrogen (N)	3	8
Phosphorus (P)[c]	1.5	3.5
Sulfur (S)	0.6	1.3
Calcium (Ca)	1	4
Magnesium (Mg)	0.4	0.8
Potassium (K)[c]	0.1	0.6

Biosolids: Fertilizer replacement value of nutrients

Nutrient	Fertilizer replacement value of biosolids nutrient ($/dry ton)
Nitrogen	19.95
Phosphorus	21.80
Potassium	4.14
Sulfur	2.66
Total	48.55

Publication under construction

Biosolids in Dryland Cropping Systems

East of the Cascades 20-yr research summary

Publication under construction

Biosolids in Dryland Cropping Systems

Biosolids effects on:

- grain yield
- crop residue (straw) production
- soil carbon (organic matter) sequestration
- soil nutrient status
- other soil health/quality indicators

Publication under construction
Biosolids in Dryland Cropping Systems

- Nitrogen and Phosphorus
- Recommended nutrient management planning practices to protect water quality, improve soil, and provide economic benefit
- Audience:
  Farmers, biosolids managers, biosolids regulators, agricultural professionals, and conservationists (NRCS & county-based districts)

Role of soil testing in biosolids management program

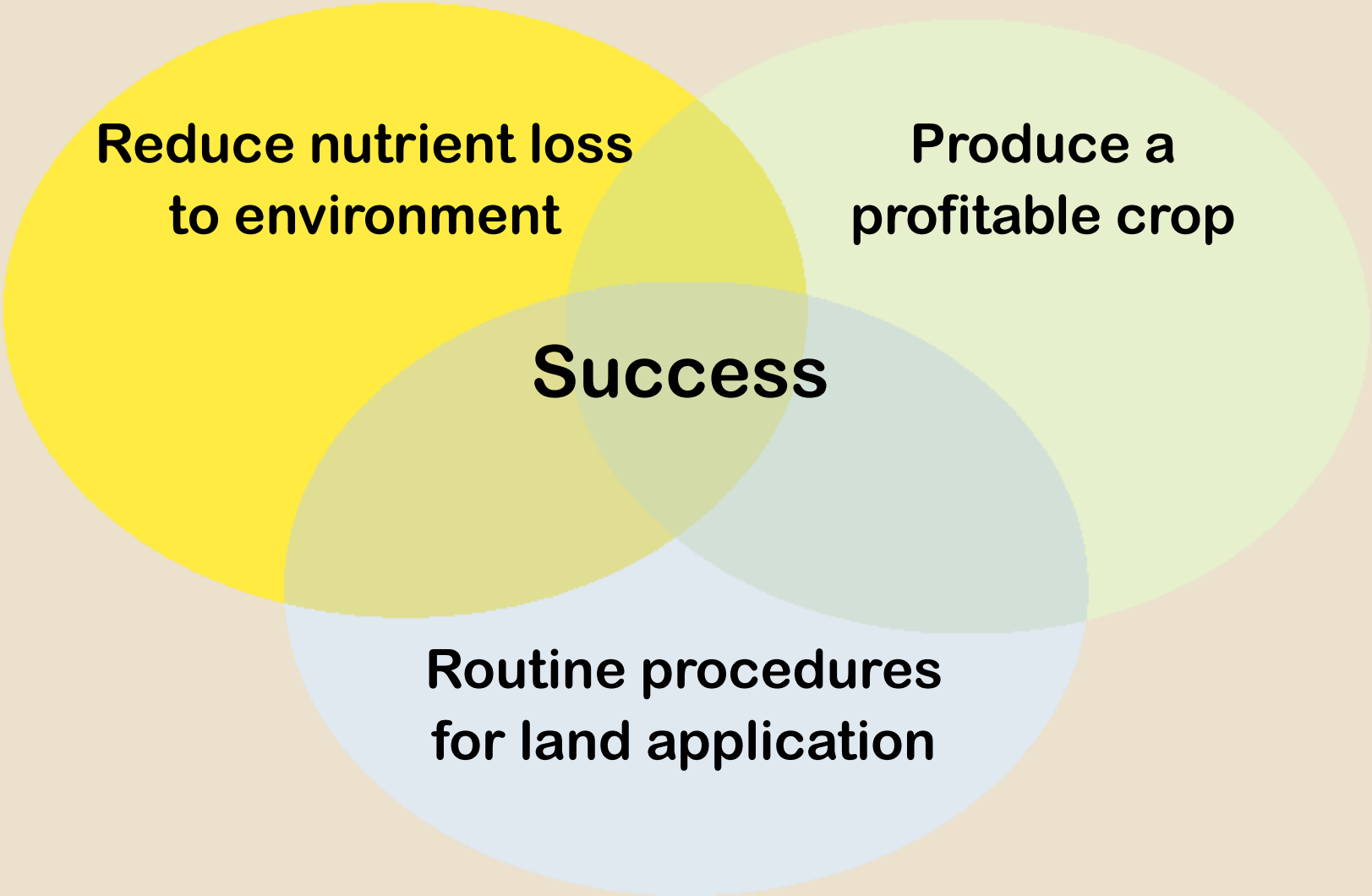
Nutrient management goals for biosolids managers

- Regulatory compliance: Agronomic rate
- Assisting farmer with his business: Crop production
- A well-designed soil testing program is an essential part of pro-active biosolids management
- Build trust in local agriculture community

Soil testing: Role in biosolids management

- Ag professionals and farmers are familiar with soil testing as a management tool
- But, they may not understand organic fertilizers
- And may not understand what an “agronomic rate” is

Soil testing:
Overlap of regulator, grower, and biosolids manager goals



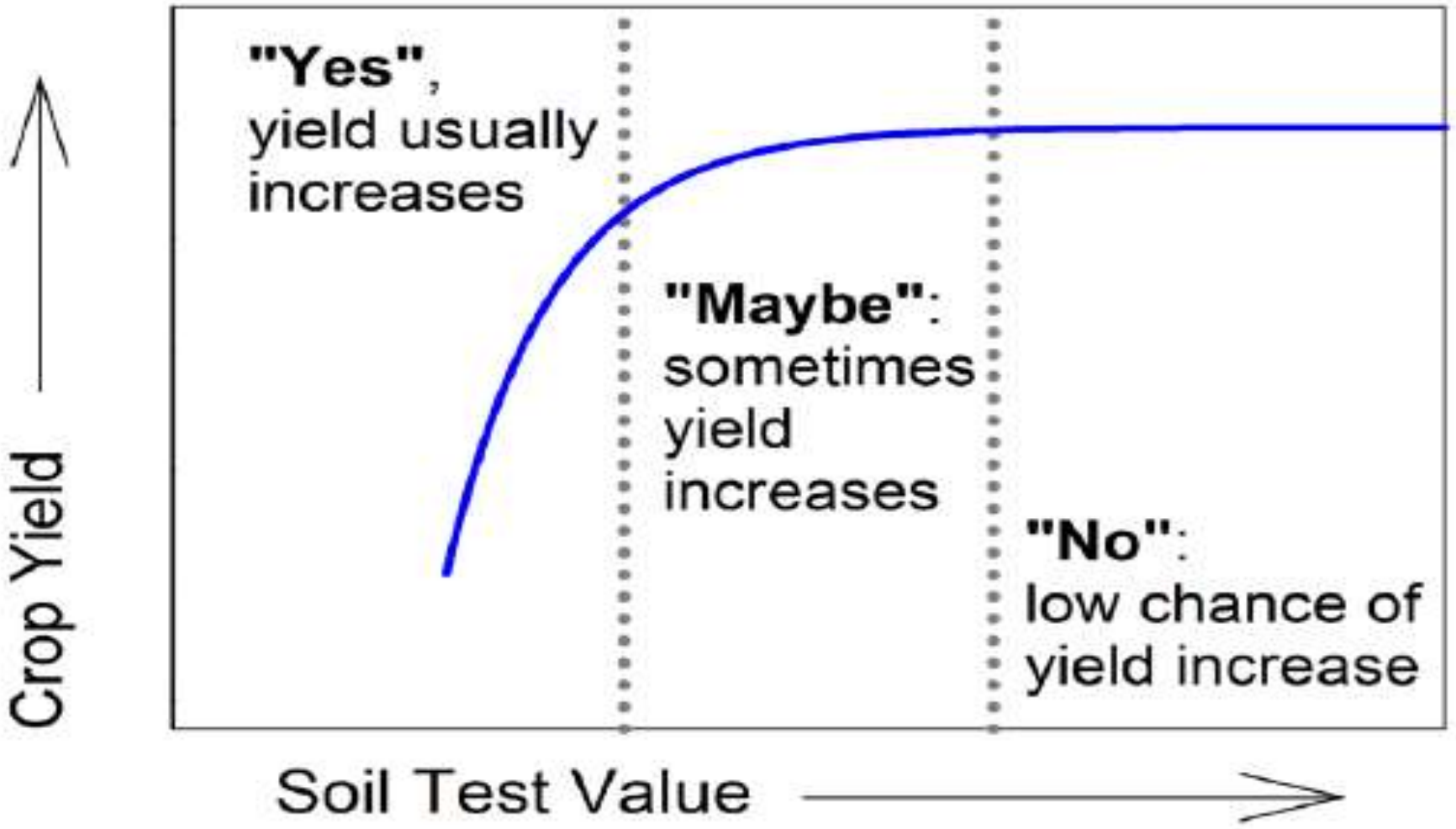
Nutrient management

- Plan
- Implement
- Monitor
- Then modify based on what monitoring data (soil, plant, irrigation water) tells you

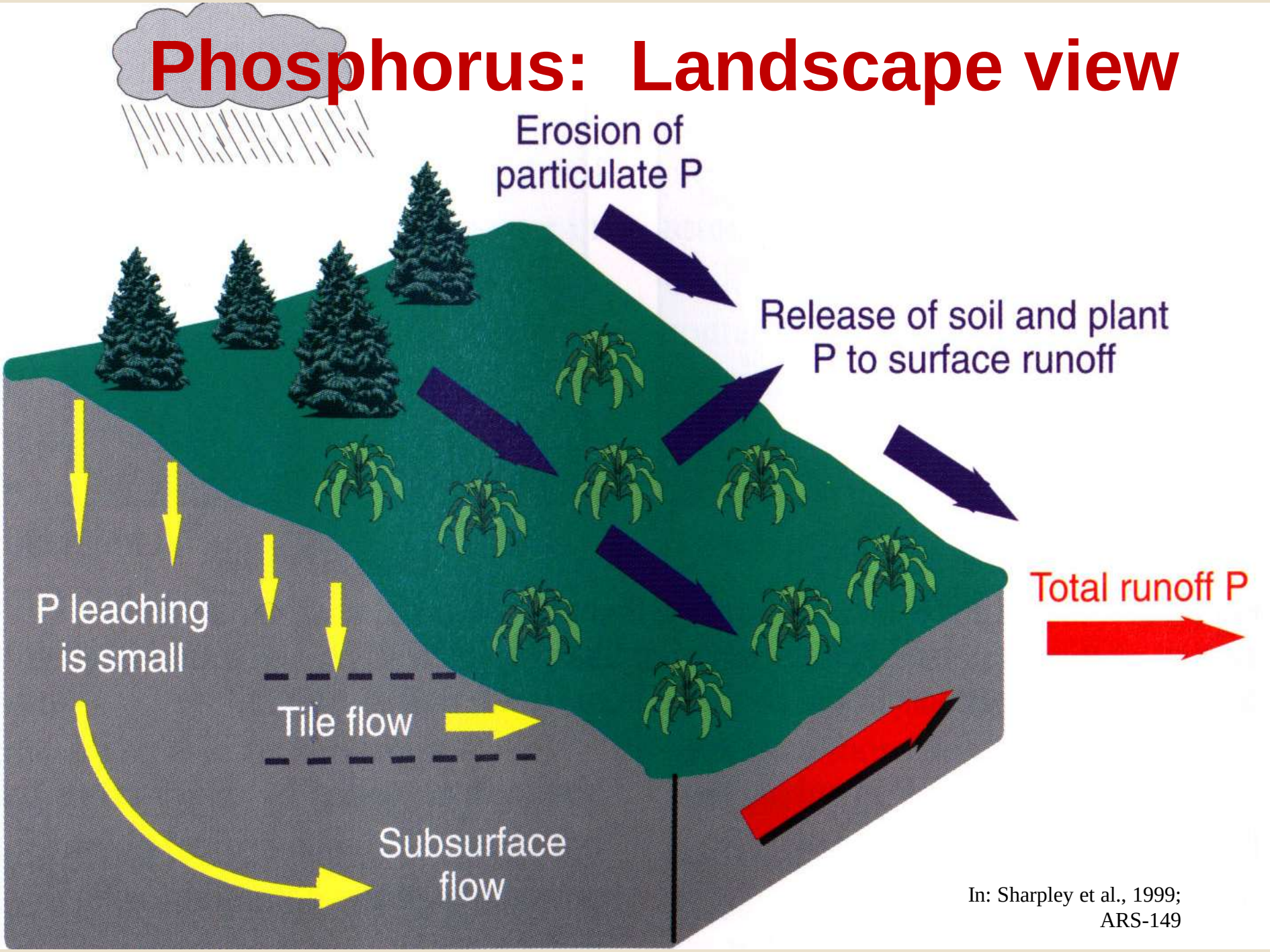
What to expect from a soil test

- Determine soil nutrient status with respect to crop production (deficient, adequate, excess)
- Determine need for lime or other amendments to adjust soil pH
- Measure change over time due to management practices, including fertilizer source, rate, timing….

Soil test value vs. crop yield response to nutrient addition



Phosphorus: Landscape view



In: Sharpley et al., 1999; ARS-149

Soil analyses: west of Cascades
(pH < 7; precipitation 30 to 50+ inches)

- soil pH
- lime requirement: SMP buffer test
- Bray P1 phosphorus
- Exchangeable cations (Ca, Mg, K)
- hot-water extractable B
- Post-harvest NO_3-N?
  - Sept 1-Oct 15

Soil analyses: east of Cascades
(pH > 7; precipitation 6 to 20 inches)

- soil pH
- soluble salt (EC)
- Olsen phosphorus
- Preplant NO_3-N (consult university nutrient guide for sample depth)
- Exchangeable cations, including sodium (Na)
- Hot water extractable B
- % $CaCO_3$ (free lime)
- DTPA extract: Zn, Fe, Mn

Interesting but probably not essential

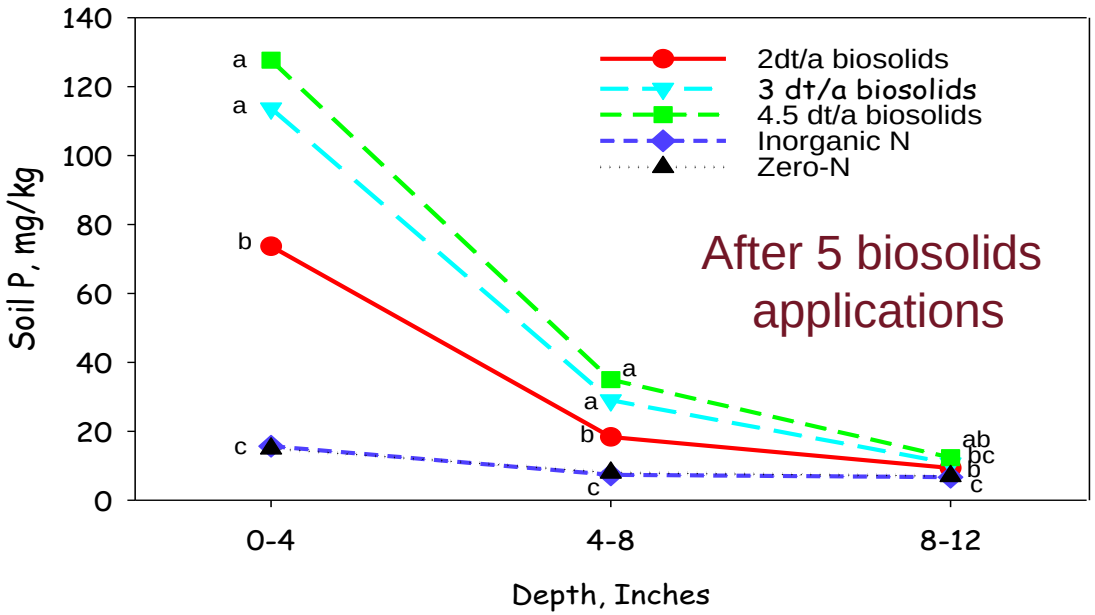
- Ammonium-N (NH_4-N)
- Sulfate-S (SO_4-S)
- Percent base saturation
- Cation exchange capacity (CEC)
- Nutrient ratios
- Soil texture
- Mineralizable N, total N
- Soil health score (Haney test)
- Organic matter or soil carbon
  - Sometimes useful for long term monitoring

Consistent soil sampling depth is critical

- Nutrients like P and K are often much higher in top inches of soil
- Especially in no-till or pasture:
  nutrients accumulate and pH changes mostly at the soil surface (0-2 inches)
- Standard sampling depth for most soil test interpretations in university guides is 12 inches in the PNW
- Consult nutrient management guide for crop before sampling

What changes you expect from repeat biosolids application

- ↑ Increase soil test P
- ↓ Maintain or decrease soil test K
- ↑ Increase soil organic matter (and total N & C)



What changes you expect from repeat biosolids application

- ↑ Increase soil NO_3-N (preplant application)
- Utilize most of the soil NO_3-N near crop harvest time (low NO_3-N in fall is the goal)
- pH and soluble salt (EC) similar to mineral N fertilization program (e.g. urea)

A Guide to Collecting Soil Samples for Farms and Gardens

M. Fery and E. Murphy

Without a soil analysis, it's nearly impossible to determine what a soil needs in order to be productive. Laboratory soil analyses (soil tests) provide information on your soil's available nutrient-supplying capacity. This information helps you select the correct kind and amount of fertilizer and liming material, which helps you develop and maintain more productive soil and increased crop production.

Recommendations in this publication are based on the results of fertilizer experiments, soil surveys, and results obtained by farmers.

Why should I collect a soil sample?

Reasons for soil sampling include the following:

- Establish baseline soil nutrient status for new landowners
- Measure change in soil nutrient status over time
- Document soil nutrient management for certification

OSU Extension pub EC 628

Good summary

of general principles

This publication is not intended to be a guide for obtaining soil samples for environmental testing.

Melissa Fery and Elizabeth Murphy, instructors, Extension Small Farms Program, Oregon State University

EC 628
Revised September 2013

Soil sampling
PNW Extension publication 570-E

PNW 570-E • October 2003

Monitoring Soil Nutrients Using a Management Unit Approach

M.L. Staben, J.W. Ellsworth, D.M. Sullivan, D. Horneck, B.D. Brown, and R.G. Stevens

Soil probe

- Collect same amount of soil from each depth
- Known sampling depth
- Easy to clean out between samples

Soil test interpretation?

Soil Test Interpretation Guide

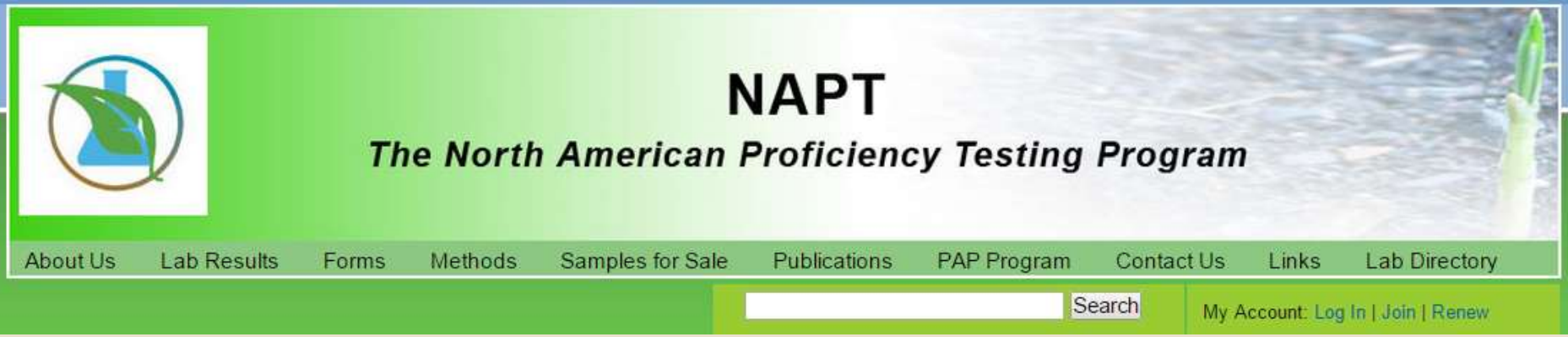
D.A. Horneck, D.M. Sullivan, J.S. Owen, and J.M. Hart

EC 1478 • Revised July 2011

- **OSU EC 1478-E**
- Most recent summary of applicable soil test methods used in the Pacific Northwest
- General reference: “approved” method, general interpretation: low, medium, high
- More specific information provided in crop/region specific nutrient management guides

Know your lab

- NAPT-PAP
- Lab choosing tips
  - Talk to them
    Visit the lab
    See lab report
    Use same lab consistently



- http://www.naptprogram.org/pap
- Voluntary soil testing quality control program supervised by Soil Science Society of America
- About 10 labs in West were “certified” in 2014
- Based on annual performance in accurate analysis of “double-blind” soil samples
- Must use NAPT-PAP lab when sampling under cost-share agreement with NRCS for nutrient management

“Reference” soil samples for sale at NAPT-PAP website

Home

Samples for Sale

Soil For Sale & Plants For Sale

To place an order for any of the samples, please complete the "Laboratory Information" and "Reference Items" section on our Enrollment/Order Form. Enrollment in the NAPT Program is not required to order reference samples.

Note: In addition to inventory, five small containers of each soil have also been set aside for research.

Soil Name	Year	Number	Small Containers Buckets	Notes	pH, sp	EC, sp	P, Olsen	P, M-3	NO3-N
Timpanogas	2008	101	24	Multi quarter 101, 107, 113, 120	5.83	2.20	31.0	82.4	94.0
Hublersburg	2008	102	28		5.00	1.42	31.0	64.5	5.0
Fallsington	2008	103	26	1/2 bucket	6.66	0.48	29.8	89.0	15.6
Declo	2008	104	31		7.86	0.76	35.0	96.9	10.0
Freehold	2008	106	31	Same as 2012-102	5.35	0.23	45.9	130.0	5.0
Blue Creek	2008	107	34	Multi quarter 101, 107, 113, 120	5.85	220.0	30.1	81.0	93.6
Ririe	2008	109	34	3 1/2 buckets	7.97	0.54	26.0	96.0	8.0

- Soil sample with a known analysis using approved agricultural soil testing methods
- Can be used to assess accuracy and consistency of analyses over time.

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