Nutrient Management

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Nutrient Management Definition

- Ensuring nutrients are applied in proper quantities, and at the right times, to meet crop requirements
- Helps achieve optimum crop yields without harming the environment

Discussion Points

- Nutrient management basics – soil test and follow the recommendation
- Why is nutrient management harder on a dairy farm than a cash grain farm using only inorganic fertilizer?
- Why do we predict plant available P and K by soil testing, but not reliably N?
- If we know 55ppm P in soil is adequate for crop growth, why do some soils test <5 and>500ppm?
- How and why would you increase soil organic matter?

Chesapeake Bay Priorities
Nutrient management vs other BMPs

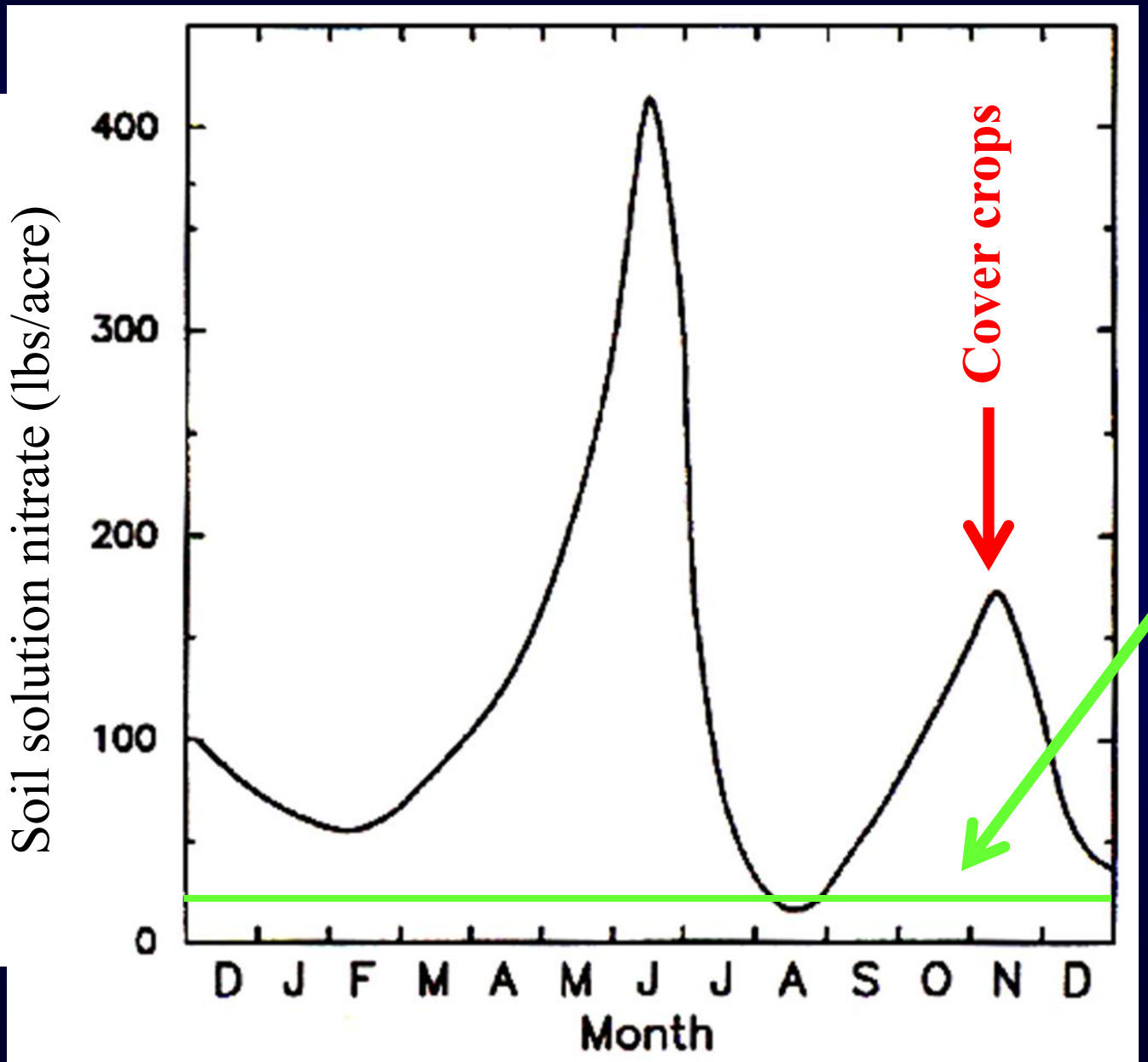
- Sediment – controlled by soil conservation practices
- Nitrogen – controlled by nutrient Management and cover crops
- Phosphorus – controlled by nutrient Management and soil conservation practices
- Why other nutrients like Potassium not included?

Nitrogen vs Phosphorus
Behave differently in soil

- Nitrogen
  - Almost all in soil organic matter
  - Released by microbial activity – difficult to predict
  - Plant available nitrate not held by soil
  - Timing of application critical
  - Over application will be gone by next year

- Phopshorus
  - Held strongly by soil
  - Released by chemical reactions – easy to predict
  - Timing of application not very important
  - Over application builds up in soil

Soil solution N and P concentration under corn



So how do farmers manage nutrient applications?

- Phosphorus, potassium, lime – soil test and follow the recommendation

- Nitrogen based on:
  - Crop to be grown – none for legumes
  - Yield estimate – e,g, 1 lb N/bu corn
  - Site history – manure applications, was previous crop a legume

Soil Testing
Basis of Nutrient Management

- Take a soil sample from a field
- Send it to a Soil Testing Lab
- Receive a fertilizer recommendation – N, P, K, lime plus some micronutrients

- Nutrient management plan additions
  - FSA Farm and field ID with acreage
  - Fertilizer applied from different sources
  - Manure calculations
  - Signed by certified Nutrient Management Planner

Taking a soil sample

Virginia Cooperative Extension
Virginia Tech • Virginia State University

Virginia Tech
Soil Testing Laboratory

Publication 452-124
Revised 2021

Soil Sample Information Sheet for Commercial Crop Production

Please write legibly or download form and type information before printing. (Form expires July 2026)

Use another form for home gardens, lawns, golf courses, etc. Follow sampling instructions on box. Processing will be delayed if soil is not received in the lab's sample container. Each sample must have its own form. For more information, go to **www.soiltest.vt.edu** or contact your local Virginia Cooperative Extension office.

Your Name: _____ Phone: _____

E-mail (results sent by email only*): _____
Adding *soiltestlab@vt.edu* to your email contact list may help ensure delivery. Also check spam folder.

Mailing Address (results not mailed): _____

City: _____ ZIP Code: _____

County Where Soil is Located (required): _____

Copy Report To (Consultant, etc.): _____

Their E-mail: _____

Date sampled: _____ MM/DD/YY

Office Use only
Extension Unit Code: _____

SAMPLE ID - must match the ID you put on box of soil. Your optional Field ID helps you match each report to the correct sample.

Sample ID use letters or numbers		**Track & Field ID** use letters or numbers	

CROP INFORMATION - a crop code number is required to provide recommendations. Only one crop may be entered for each sample.

Crop to be Grown		**Last Crop (if a legume)**		
Crop Code # (from list on back)	Name	Crop Code # (from list on back)	Name	Yield Bu/A, T/A, etc.

SOIL INFORMATION - optional, but provides better recommendations. More information can be found on the reverse side of this form.

Last Lime Application		Check ☑ if
Months Previous	Rate Ton/Acre	
◯ Unknown	◯ 0	☐ Field has artificial drainage
◯ 0-6	◯ 0.1-1.0	☐ Soil is a Histosol
◯ 7-12	◯ 1.1-2.0	☐ Manure will be applied
◯ 13-18	◯ 2.1-3.0	
◯ 19+	◯ 3.1+	

Prominent Soils in Field (see back)		**Your Yield Estimate**	
Soil Map Unit Symbol for:*	Percent (%) of Field	(For crop to be grown)	Select Units
Largest area			◯ Ton/Acre
2nd Largest area			◯ Bushel/Acre
3rd Largest area			◯ Acre/AU**

* SMUs can be obtained from a County Soil Survey or NRCS Conservation plan.

** 1 Animal Unit = one 1000lb cow w/ calf, two 500lb steers, or five ewes w/ lambs.

SOIL TEST DESIRED AND FEES

	In-State cost per sample	Out-of-State cost per sample
☐ Routine (soil pH, P, K, Ca, Mg, Zn, Mn, Cu, Fe, B, and estimated CEC)	No-Charge	$16.00
☐ Organic Matter – Determines percentage in soil - no recommendation given	$4.00	$6.00
☐ Soluble Salts – Determines if fertilizer salts are too high	$2.00	$3.00

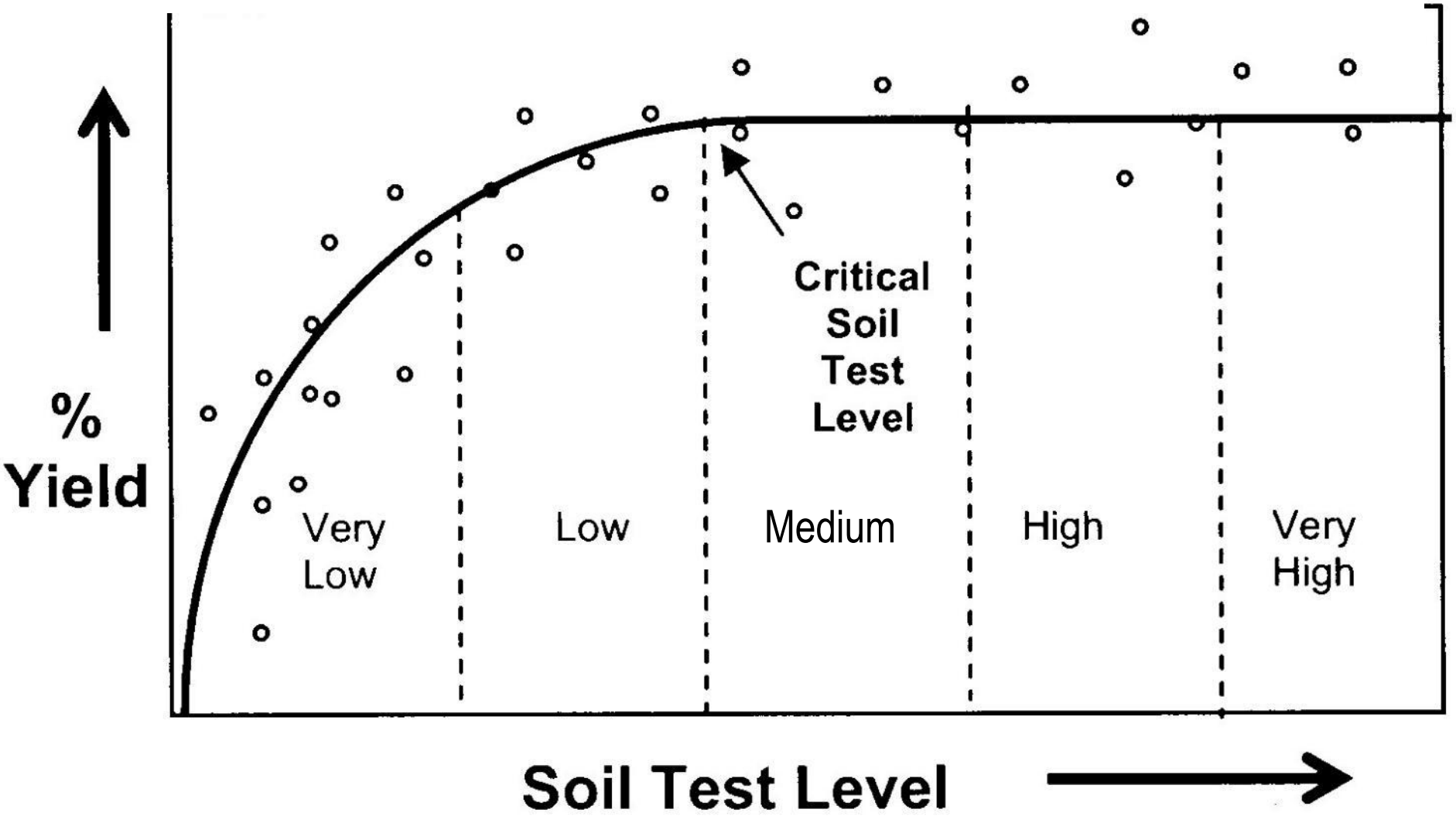
Method of payment: ☐ Check Enclosed ☐ Bill my Business Tax ID# required for billing _____

Samples ready for drying

Soil Testing Lab, Virginia Tech

Soil Testing – Nutrient Extraction

Calibration Curve



Soil Test Level vs Fertilizer Recommendation

Crop: Corn for Grain (No-Till or Conventional)

VALUES Crop Code: 1, 2, 401, 402

Target pH = 6.2

See Notes: 1, 2, (4, 5)

Possible Trace Element Need: Zn (see page 8)

Soil Productivity Groups I, II

Soil Test Level	Fertilizer Recommendations (lb/A)		
	N	P_2O_5	K_2O
L	1 lb. of N/Bu of expected yield	100 - 140	100 - 140
M		60 - 100	60 - 100
H		20 - 60	20 - 60
VH		0	0

Example Soil Test Report

Sample ID	Field ID	LAST CROP		LAST LIME APPLICATION		SOIL INFORMATION				
		Name	Yield	Months Prev.	Tons/Acre	SMU-1 %	SMU-2 %	SMU-3 %	Yield Estimate	Productivity Group
1		Orchardgrass/Fescue-Clover Pasture (40)								III

LAB TEST RESULTS (see Note 1)

Analysis	P (lb/A)	K (lb/A)	Ca (lb/A)	Mg (lb/A)	Zn (ppm)	Mn (ppm)	Cu (ppm)	Fe (ppm)	B (ppm)	S.Salts (ppm)
Result	3	103	2932	438	1.1	10.3	1.5	14.3	0.3	
Rating	L-	M	VH	VH	SUFF	SUFF	SUFF	SUFF	SUFF	

Analysis	Soil pH	Buffer Index	Est.-CEC (meq/100g)	Acidity (%)	Base Sat. (%)	Ca Sat. (%)	Mg Sat. (%)	K Sat. (%)	Organic Matter (%)
Result	5.7	6.08	11.1	17.0	83.0	65.6	16.2	1.2	2.4

FERTILIZER AND LIMESTONE RECOMMENDATIONS

Crop: Orchardgrass/Fescue-Clover Pasture (40)

Lime, Tons/Acre		Fertilizer, lb/A		
Amount	Type	N	P205	K20
2	AG	See Comment	60	40

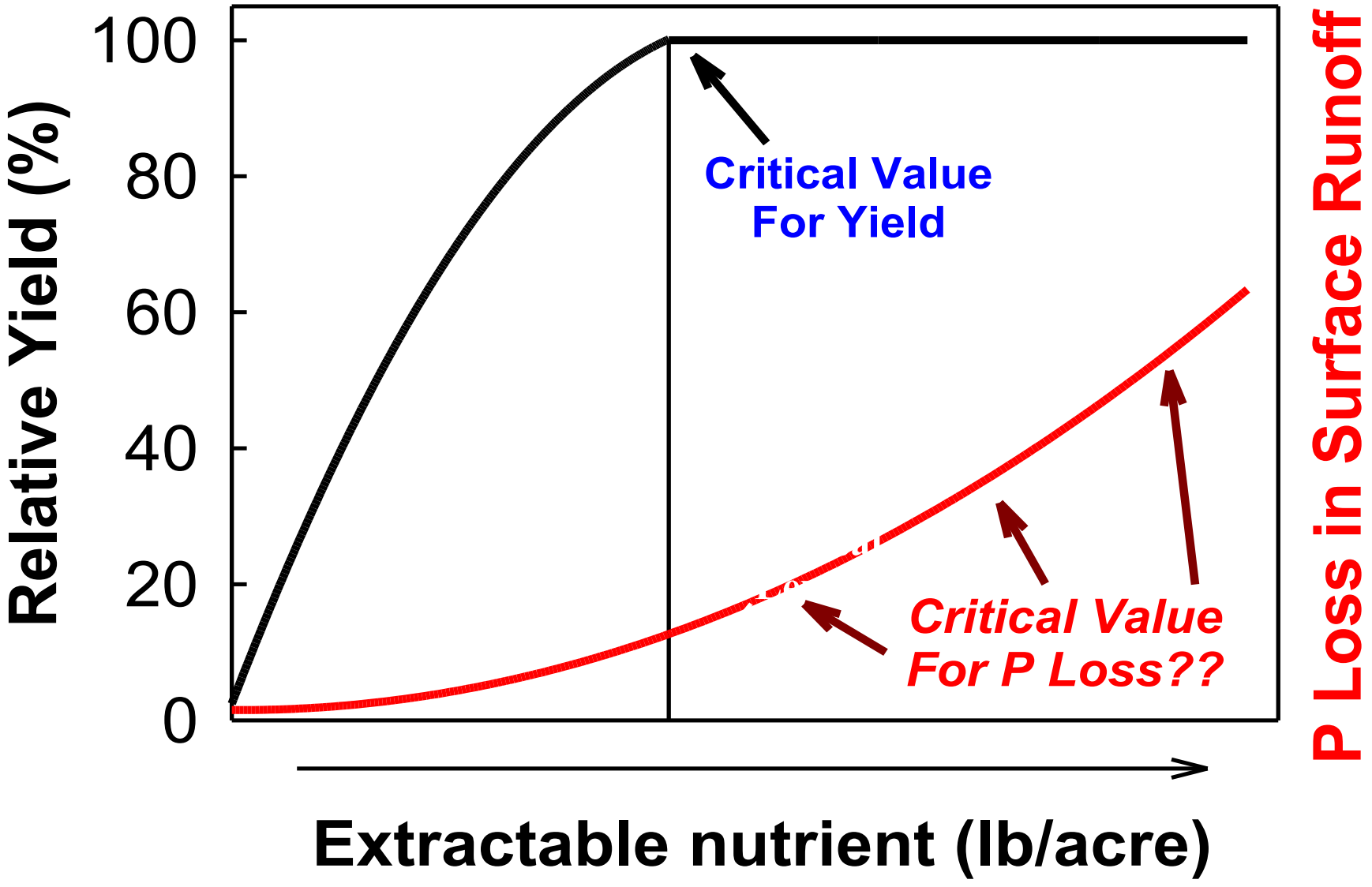
825. If stand contains less than 25 percent clover, apply 40-60 lbs N/A.

131. If additional production is needed later on, apply 40 to 60 lbs/A of N during the grazing season. If you are planning to overseed a legume into the stand, omit the N recommendation.

122. P2O5 and K2O recommendations are for annual application. However, rates can be doubled and applied every other year if desired.

991. "Explanation of Soil Tests, Note 1" and other referenced notes are viewable at www.soiltest.vt.edu under Report Notes.

Don't have to choose between good production and environmental protection

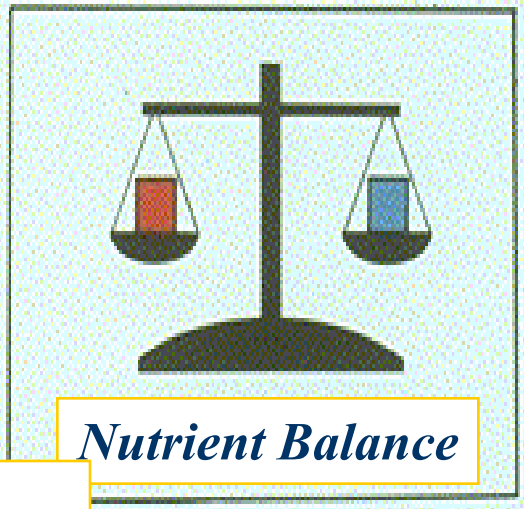


Cash Grain Farm

Nutrients Out: ***Harvested Crops***

Crops

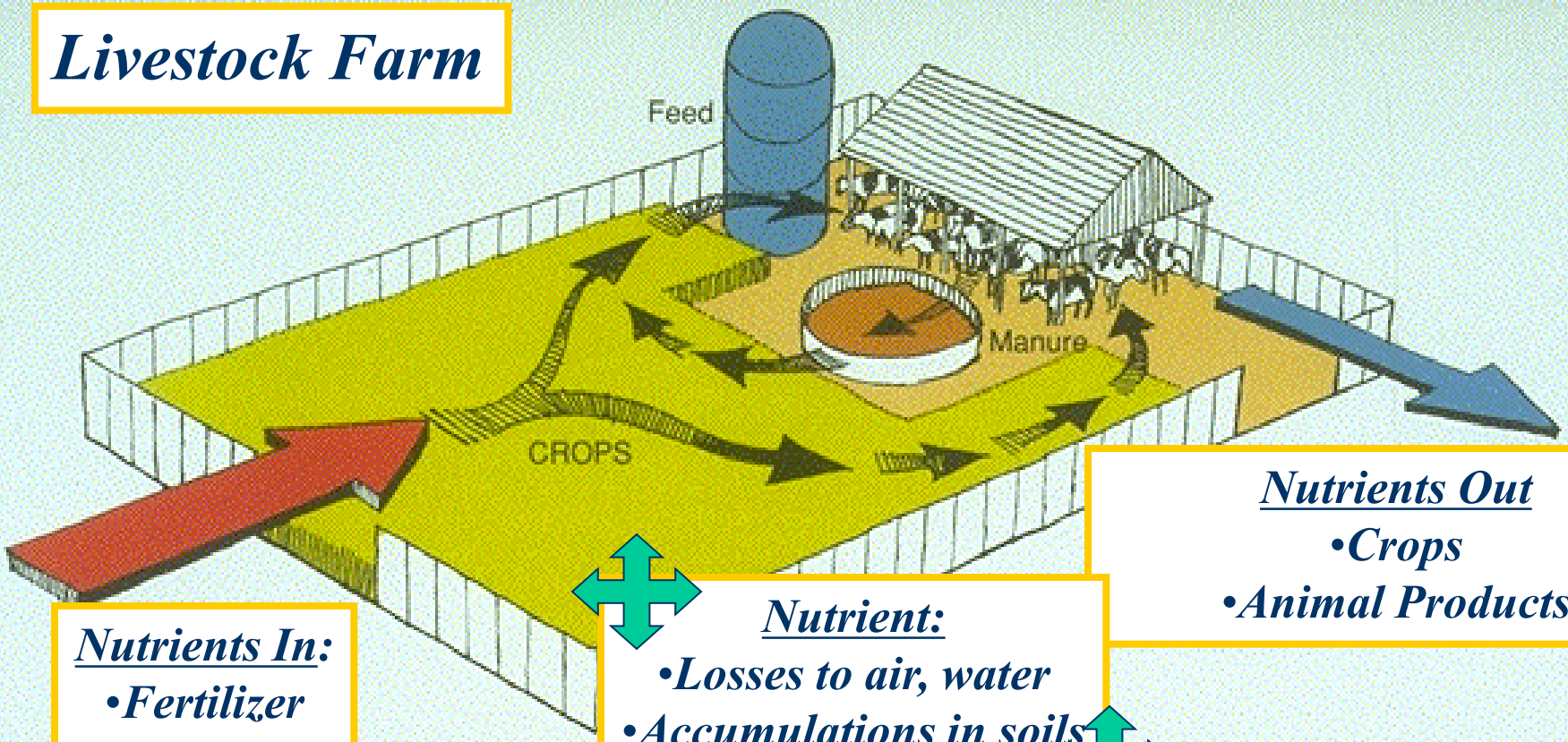
Nutrients In: ***Fertilizer***



Nutrient Balance

“Nutrient balance on a cash grain farm is simple”

Livestock Farm



Nutrients In:
- Fertilizer
- Feed

Nutrient:
- Losses to air, water
- Accumulations in soils

Nutrients Out
- Crops
- Animal Products

Can't change volume of manure produced

Can't change N:P ratio

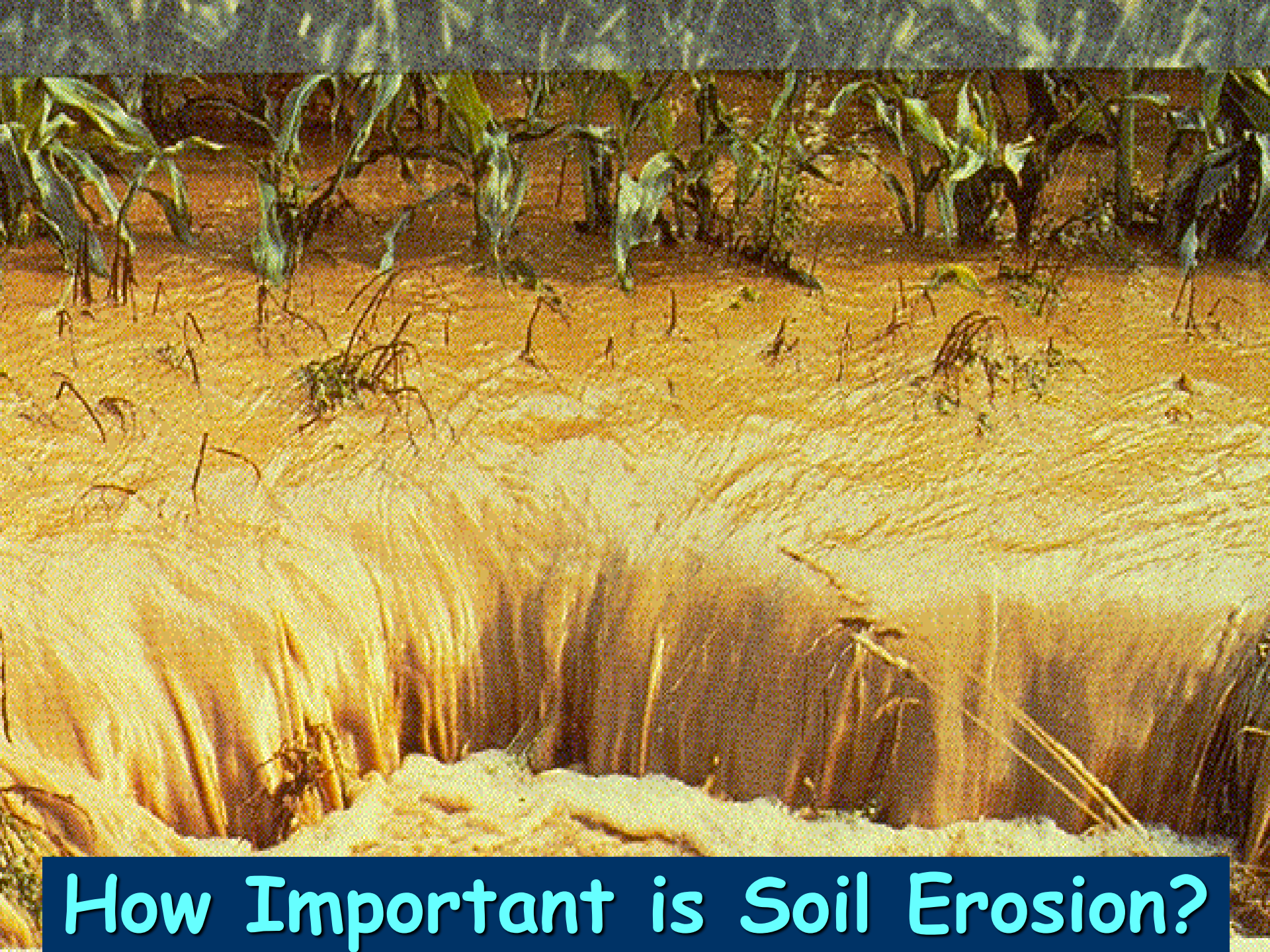
Applying enough N applies about 3 years of P – 3 year NMP

Not all nitrogen plant available

Intensification good for economics, bad for nutrients

Poultry vs Dairy on Farms with more Manure than Crops Need

- ✓ Poultry
  - ✓ Export poultry litter, fairly dry and in demand
- ✓ Dairy more complicated as 95% water
  - ✓ Export manure
  - ✓ Grow rather than import feed
  - ✓ Avoid high P feed like DDG
  - ✓ Export value added products like compost



How Important is Soil Erosion?

Best Management Practices

Residue cover

Cover Crops

Grow N - Legumes

Best Management Practices

Manure Injection

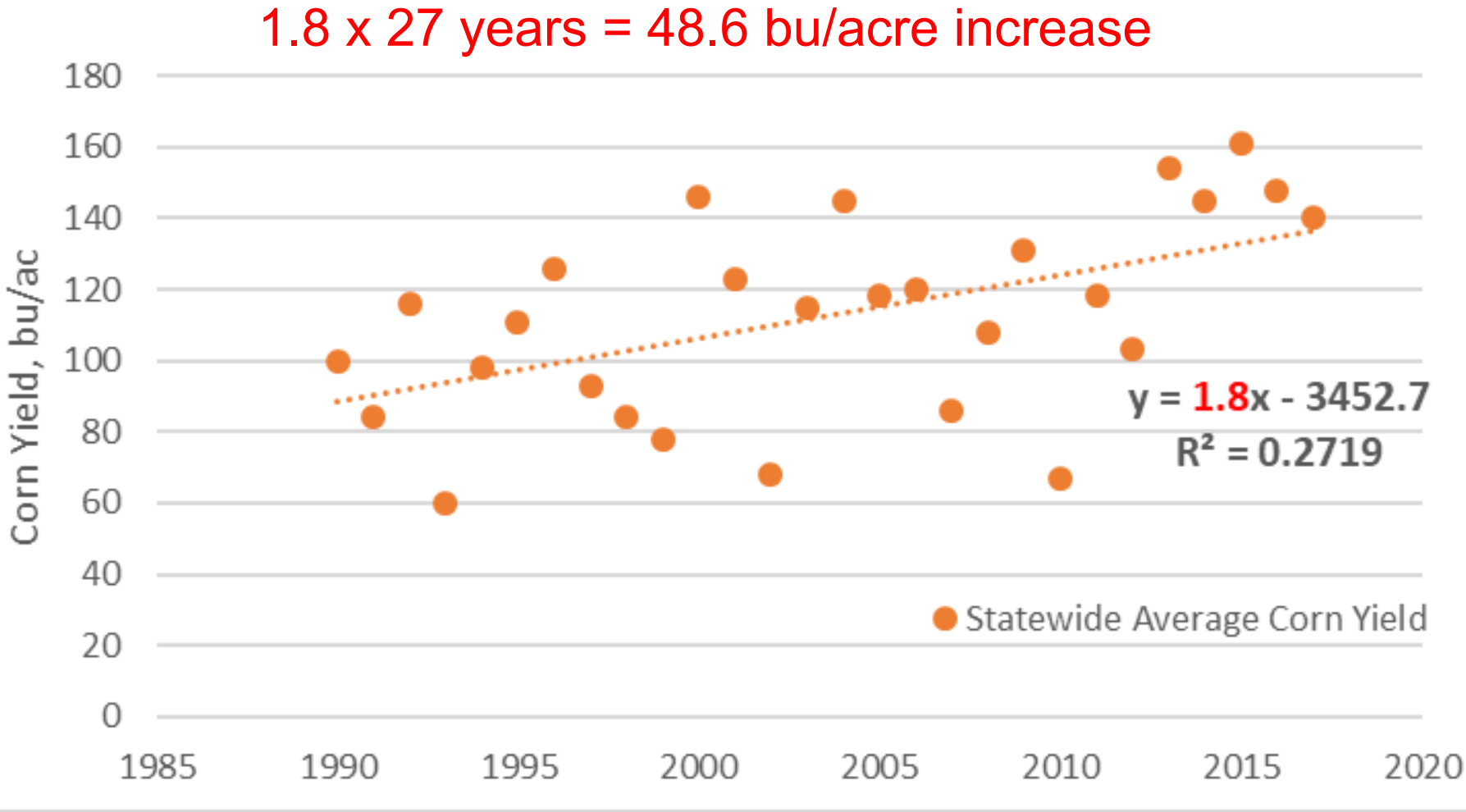
Tillage vs no-till

Water Quality meets Soil Health

Co-benefits with Soil Health

- **Reduce Soil Disturbance** (less soil erosion, build soil OM)
- **Keep the soil covered** (more residue cover, less soil erosion)
- **Cover crops** (prevent nitrate leaching, build soil OM)
- **Energize with diversity** (grow your own nitrogen with legumes)

Virginia Corn Yields 1990-2017
LGU Research needs to keep up



Conclusions

- ✓ Nutrient management planning is based on soil testing, then following the fertilizer recommendation
- ✓ An NMP contains additional details such as Farm and Field ID and written by certified planner
- ✓ Manure is a great fertilizer, but adds complications

Conclusions

- ✓Nitrogen enters the Bay via leaching, prevented by accurate timely applications and cover crops
- ✓Phosphorus enters the Bay primarily through soil erosion, prevented by efficient fertilization and soil conservation. Soluble P occasionally an issue
- ✓Lots of effective BMPs which overlap with Soil Health practices