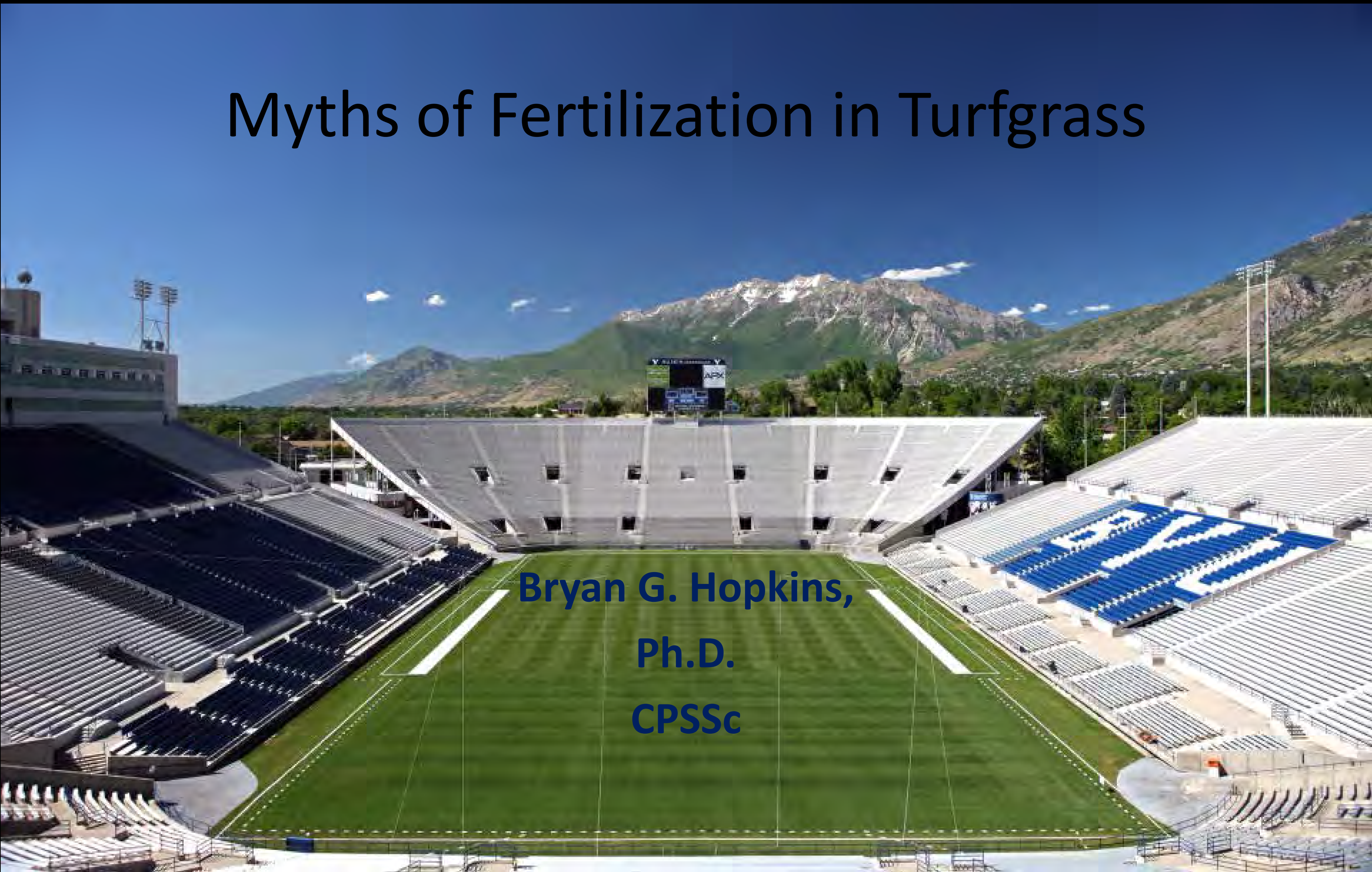
Myths of Fertilization in Turfgrass

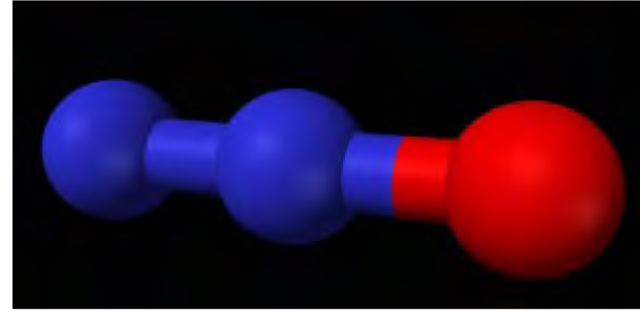


Bryan G. Hopkins, Ph.D. CPSSc

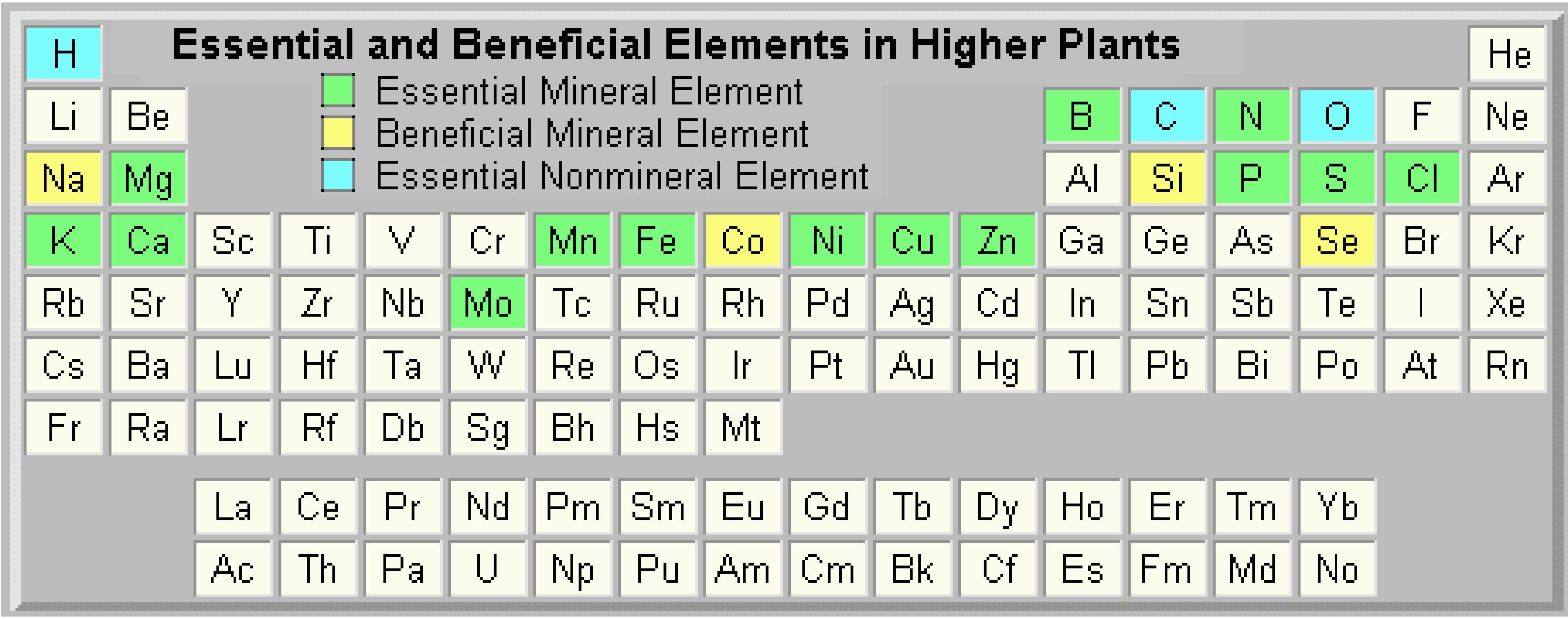
Fertility Imperative

- Aesthetics
- Athlete Safety
- Environment
  - Good
  - Bad?

Nutrient Pollution

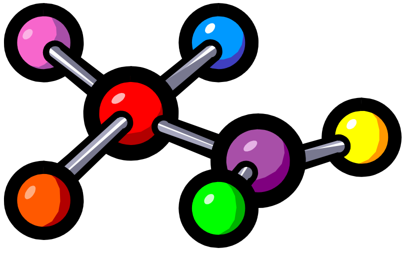


- Nitrogen
  - Nitrate in Groundwater (& surface water)
  - Nitrous Oxide gas (denitrification)
    - 8% of anthropogenic emissions, but 300 times more potent and carbon dioxide
  - Ammonia (volatilization)
    - Reactive atmospheric nitrogen deposited in sensitive ecosystems
      - Alpine
      - Water
- Phosphorus
  - Eutrophication


Essential and Beneficial Elements in Higher Plants
Essential Mineral Element
Beneficial Mineral Element
Essential Nonmineral Element
H He
Li Be B C N O F Ne
Na Mg Al Si P S Cl Ar
K Ca Sc Ti V Cr Mn Fe Co Ni Cu Zn Ga Ge As Se Br Kr
Rb Sr Y Zr Nb Mo Tc Ru Rh Pd Ag Cd In Sn Sb Te I Xe
Cs Ba Lu Hf Ta W Re Os Ir Pt Au Hg Tl Pb Bi Po At Rn
Fr Ra Lr Rf Db Sg Bh Hs Mt
La Ce Pr Nd Pm Sm Eu Gd Tb Dy Ho Er Tm Yb
Ac Th Pa U Np Pu Am Cm Bk Cf Es Fm Md No

16 Essential Elements

Organic	------------------Inorganic	------------------		
	--Macronutrients--		*--Micronutrients--*	
Carbon (C)	Nitrogen (N)	Calcium (Ca)	Zinc (Zn)	Copper (Cu)
Hydrogen (H)	Phosphorus (P)	Magnesium (Mg)	Iron (Fe)	Boron (B)
Oxygen (O)	Potassium (K)	Sulfur (S)	Manganese (Mn)	Chloride (Cl)
			Molybdenum (Mo)	

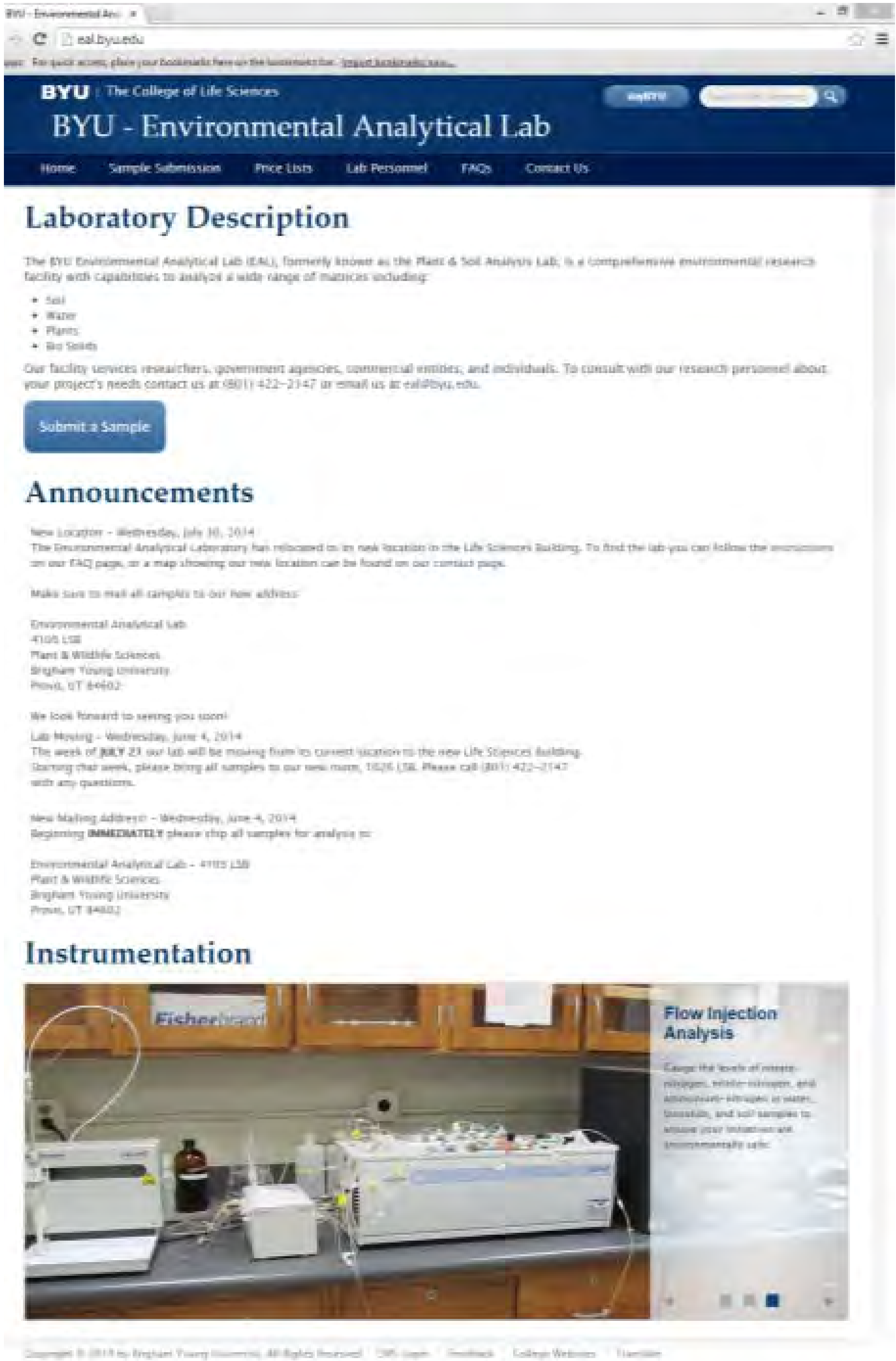


Soils are not all the same

Farmers know the value of soil and plant tissue analysis in guiding their management.

The only way to KNOW is to test (Don’t guess . . . Soil test)

http://eal.byu.edu/



Soil Sampling Instructions for Homeowners

Bryan G. Hopkins, Soil Scientist

1) Decide on how many samples are to be taken. Samples analyses typically cost between $15 and $30 each, plus shipping. Each sampling area should be unique. In other words, do not combine your garden with your lawn. Some people may only be able to afford to sample their lawn or other yard area. Others may want to sample several areas separately, but do not combine unique areas as this will make the sample results invalid. It is common to sample the following areas: front lawn, back lawn, vegetable garden, orchard, and flower beds. Any area that has the same type of vegetation and has the same type of soil, as well as has been fertilized the same over the last few years can be combined into one sample. Be sure to sample problem areas separately for diagnostic purposes.
2) Obtain sample bags and borrow a soil probe from the extension office or a garden center. It is best to use clean, cloth bags so that the soil can breathe. Paper bags will also work if the soil is not wet. Avoid plastic bags unless the sample is to be sent to the lab within 24 hours and kept cool.
3) Get a clean plastic bucket for collecting and mixing soil cores. Do not use rubber or metal buckets (stainless steel is ok).
4) Insert the probe into the soil to the appropriate depth and extract a soil core. Turf, pasture, and other permanent sod areas should be sampled to a depth of 4 inches. Vegetable, shrub, and flower gardens should be sampled to the depth of tillage (8-12 inches). Ideally, trees should be sampled to a depth of 2-3 feet around the drip-line of the tree or in the root zone for trees to be planted. Do not worry about removing small amounts of living or dead vegetation. Sampling is easier if loose soil is stepped on to firm it up before inserting the probe. It is also easier to sample soil that is moist rather than dry. Knock the core into the plastic bucket.
5) Collect 8 to 20 cores from the area to be sampled (the larger the area, the more cores should be taken to result in a sample that accurately represents the average). Walk in a zig-zag pattern around the area to be sampled, and take cores randomly.
6) Mix the soil with clean hands or gloves. Make sure that nothing that has fertilizer dust comes into contact with the soil (gloves are often contaminated). Do not use rubber or metal (stainless steel is ok) devices to break up soil.
7) Mark the soil sample bag. Be sure to write your name, address, and unique sample identification on each bag. Also, note on the sample bag the depth of the sample. If a compacted layer, rock, etc. prevent inserting the probe to the desired depth, then take the soil cores to whatever depth is possible and record the average depth.
8) Pour the soil into the bag and seal it shut with string, zip ties, tape, etc.
9) Send the samples to the extension office or directly to the soil testing laboratory as soon as possible. The county extension office can usually provide a list of acceptable soil testing labs, but remember that not all labs do good work. If the samples are to be stored, make sure that they are kept cool (preferable) or frozen. Avoid long periods of heat. Also, avoid allowing the bags to come into contact with anything that could contaminate the soil (fertilizer dust is the biggest problem, but any solid or liquid material may have contaminants).

Taking a Good Soil Sample

- How many samples?
- How many cores per sample?
- Contamination
- Paper or cloth bag
- Send to lab immediately

Soil Analysis

- pH
  - Ideal is 6.5 to 7.3
  - Below 6.5 add lime based on buffer pH
  - Above 7.3
    - Live with it – add more phosphorus and micronutrients
    - Or, lower the pH

Soil Analysis

- Nitrogen
  - Nitrate is generally the most common form of nitrogen that is plant available.
  - Avoid excesses in the soil.
  - Spoon feed regardless of soil test, just increase or decrease amount per application based on periodic soil sampling. (Evaluate the water too)

Soil Analysis

- Phosphorus (P)
  - Keep adding phosphorus annually until the value reaches the “medium” category
    - 3-6 pounds per 1000 sq. ft.
    - best if it is tilled in to the soil
  - Definitely should stop fertilizing once the soil test is “high”

Soil Analysis

- Potassium (K)
  - Keep adding potassium annually until level is greater than 300 ppm for sports turf (monitor tissue?)
    - 3-6 pounds per 1000 sq. ft.
  - Unlike P, excess is not harmful (just wasteful)

Other Nutrients

- Not as commonly deficient, except on very sandy soil, especially with low organic matter.
- Sulfur – Especially important for grass.

Other Nutrients

- Iron commonly deficient at high soil pH
  - Fertilizer doesn’t correct very well, unless applied in a concentrated band
  - Plant tolerant species
  - Foliar sprays work, but have to apply every 10 days

Other Things on a Soil Test

- Salts
  - Soluble salts (EC) become a problem if greater than 1-4
  - Correct by over watering until salts are flushed
- Sodium
  - Excess destroys soil structure (too much magnesium can also)
  - Add a soluble calcium source (gypsum), if sodium levels are greater than 5%

Other Things on a Soil Test

- CEC
  - Indicates texture and organic matter
  - Generally,
    - Sands have a CEC of 1-10
    - Loam 11-20
    - Clay >20

Fertilizer Application

- Most homeowners just spread whatever product they buy from the garden store, but they are usually wrong.
  - Not enough, or
  - Toxicities
- Customize based on soil test

Types of Fertilizers

Single Nutrient
("Simple" or "Materials")

Multinutrient
("Mixed Fertilizers" or "Complexes")

Uniform State Fertilizer Bill
LABELING

Calculation Formula

(rate of desired nutrient) X (area of garden) / grade of desired nutrient = amount to apply

Units: rate of desired nutrient (lbs./sq.ft.)

area of garden (sq.ft.)

grade of nutrient (%)

Example Problem

- Garden area: 50 ft. X 50 ft.
- Fertilizer analysis: 30-10-20
- Need to apply: 2 lbs. of N per 1000 square feet

Example Problem Solution

$$\frac{(2 \text{ lbs.}/1000 \text{ sq.ft.}) \times (2500 \text{ sq.ft.})}{30\% \text{ N}}$$

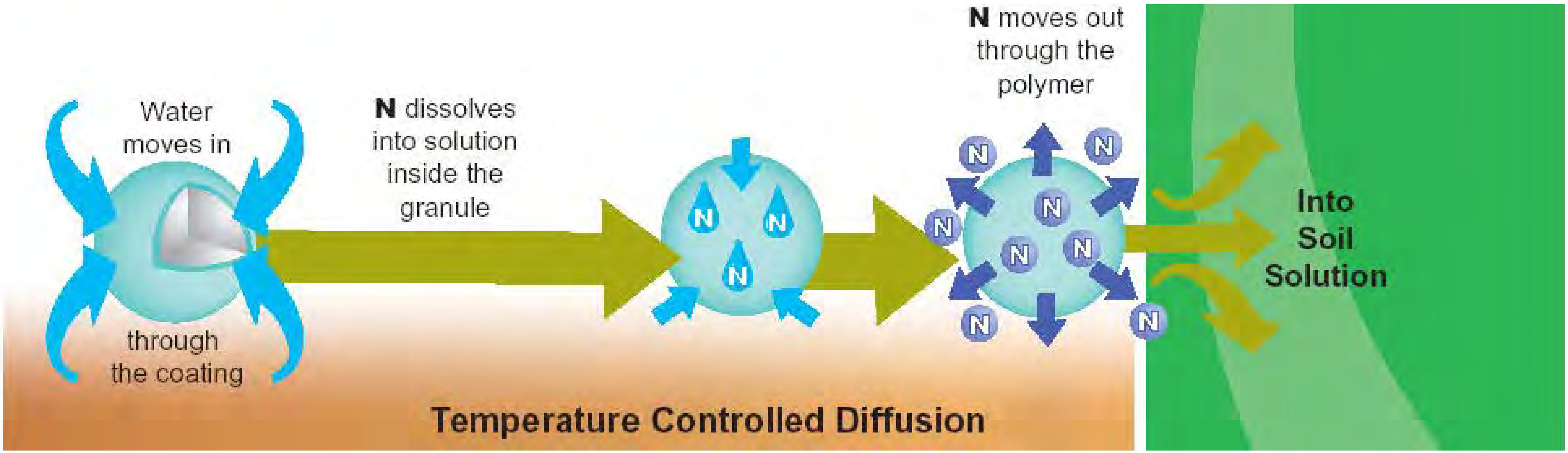
16.7 lbs. of fertilizer to apply

Common, Cheap Fertilizers

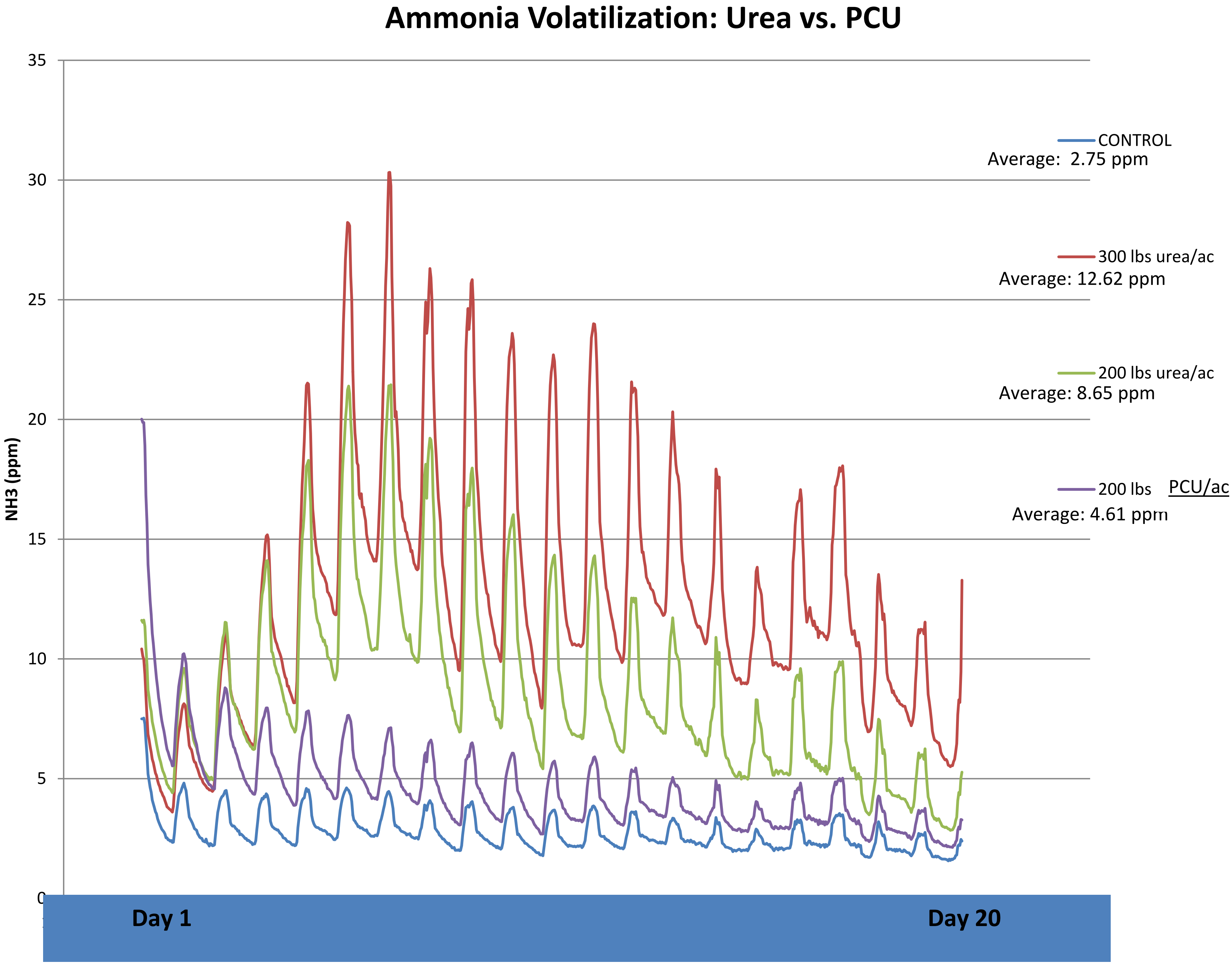
- 46-0-0 urea
- 34-0-0 ammonium nitrate
- 21-0-0-24 ammonium sulfate
- 18-46-0 diammonium phosphate
- 11-52-0 monoammonium phosphate
- 0-0-60 potash
- 0-0-52-17 potassium sulfate

Recognize this guy?

PCU

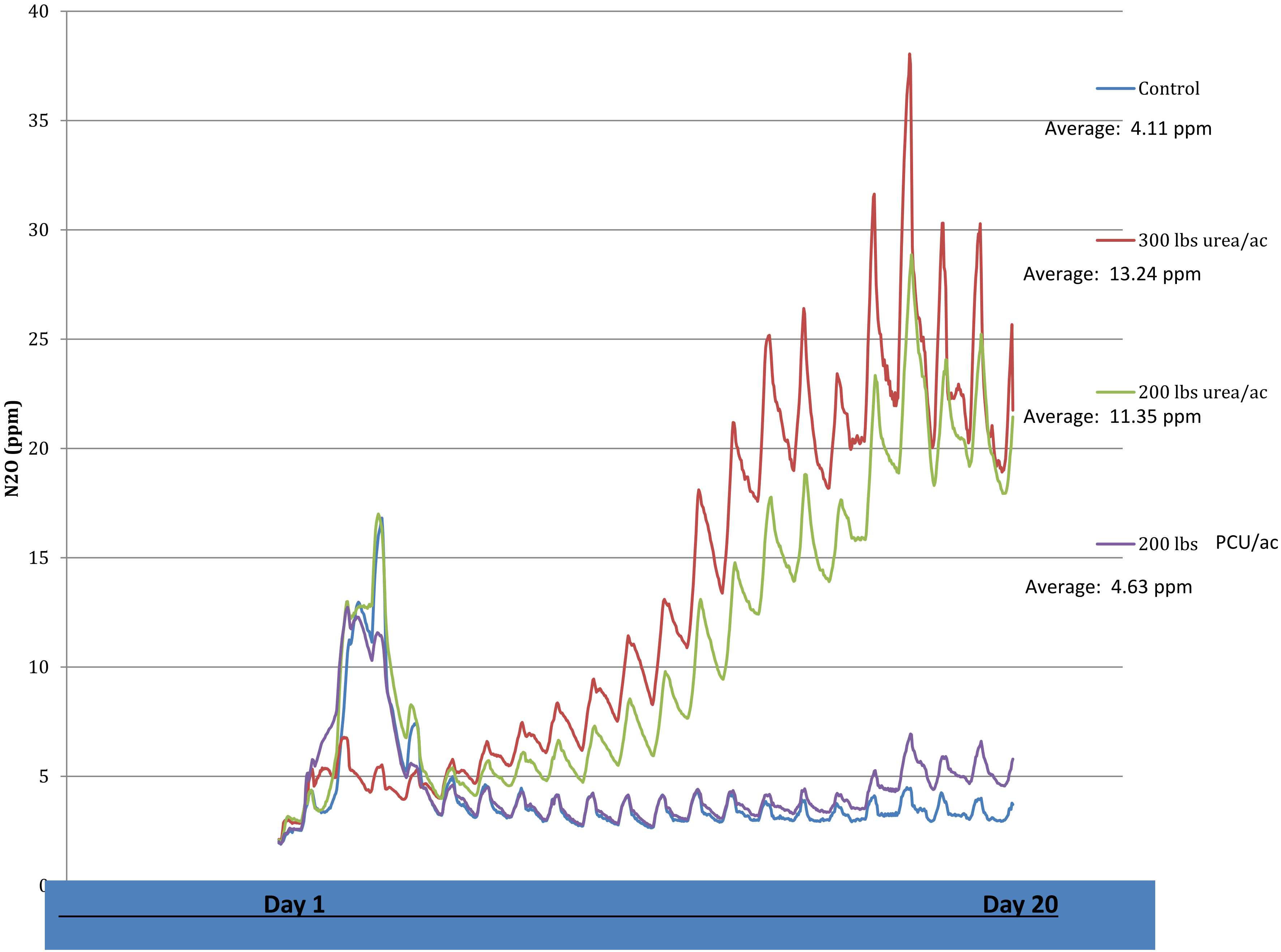


Water moves in
through the coating
N dissolves into solution inside the granule
N moves out through the polymer
Into Soil Solution
Temperature Controlled Diffusion



Ammonia Volatilization: Urea vs. PCU
35
30
25
20
15
10
5
0
NH3 (ppm)
CONTROL
Average: 2.75 ppm
300 lbs urea/ac
Average: 12.62 ppm
200 lbs urea/ac
Average: 8.65 ppm
200 lbs PCU/ac
Average: 4.61 ppm
Day 1
Day 20

Nitrous Oxide Emissions: Urea vs. PCU



Questions