



FERTILIZERS

Fertilizers vs other organic N sources

- Guaranteed minimum nutrient content
- Processed
 - Nutrients more readily available
 - Less variable composition
- Expensive!

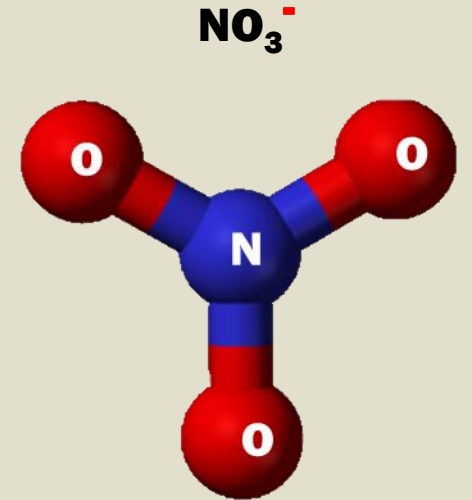
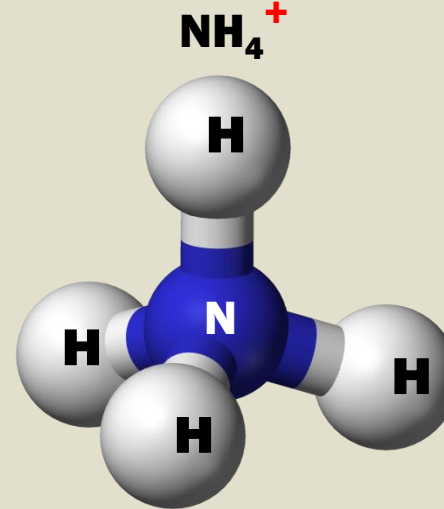
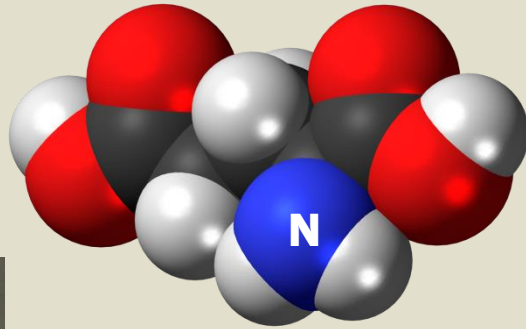
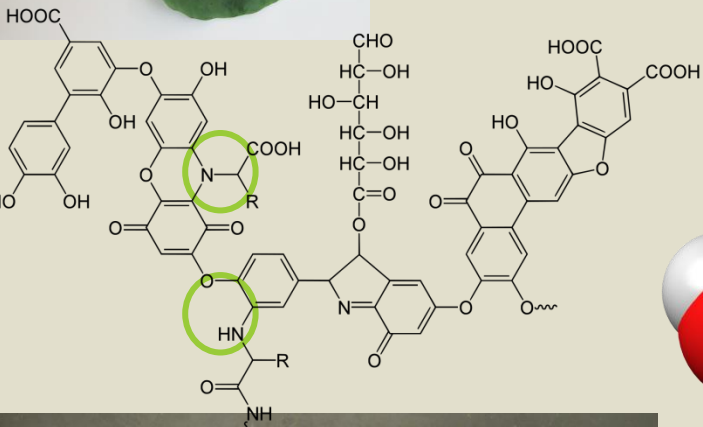
Review: nitrogen transformations

Complex organic forms \longrightarrow Simpler organic forms \longrightarrow **Ammonium** \longrightarrow (Nitrite) \longrightarrow **Nitrate**
 NO_3^-

“Breakdown”

“Mineralization”

“Nitrification”



All these processes are done by enzymes, happen faster at higher moisture, temperature

“Organic” nitrogen

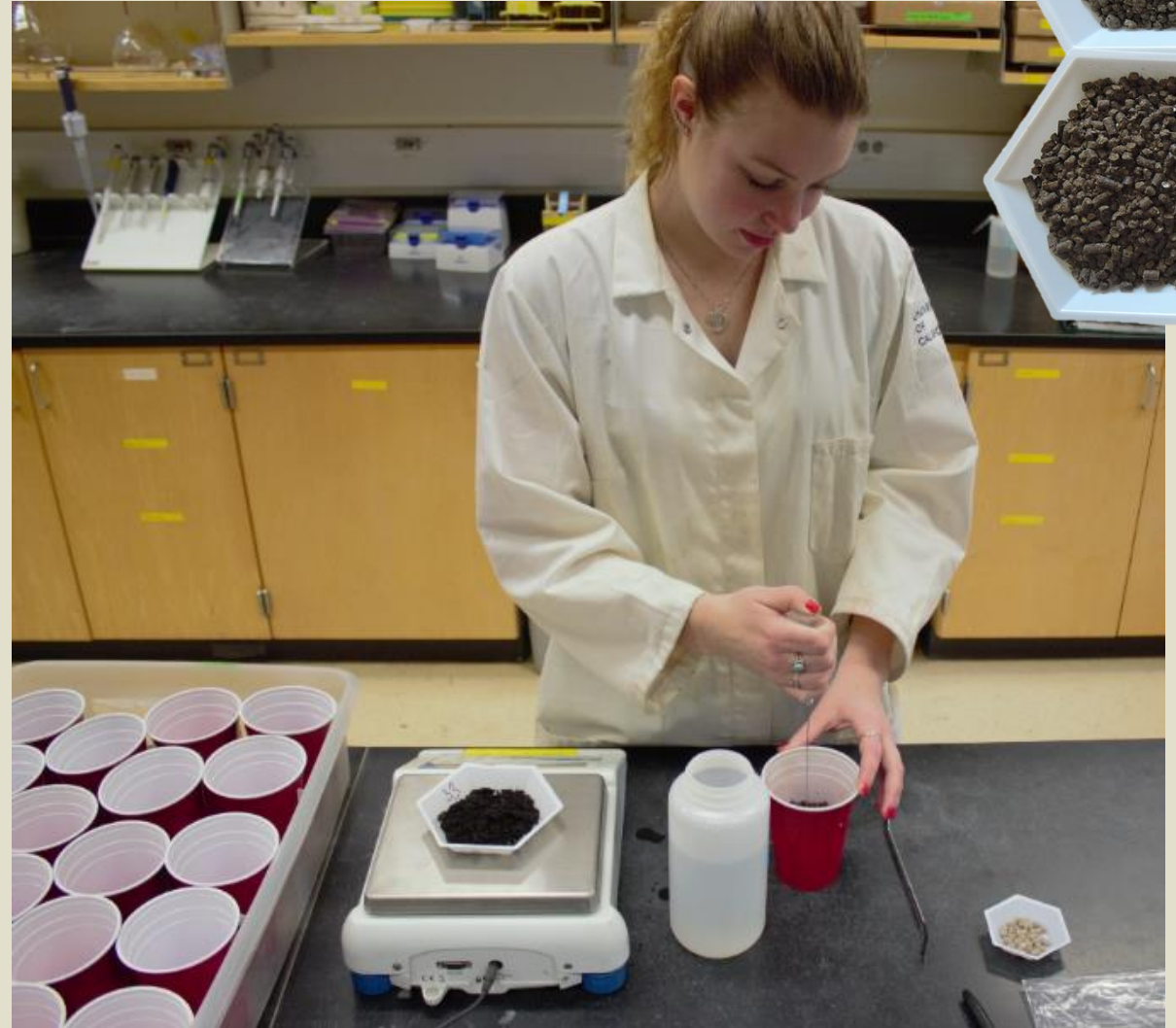
“Mineral” nitrogen –form plants normally use

Types of fertilizers

- Slaughter products (i.e. blood and feather meals)
- Granular formulations
- Liquids

How much N becomes available?

- Incubation experiment
- Optimum moisture, 75°F
- Sample at 0, 1, 3, 6, 12 weeks
- Additional at 40°, 60°F

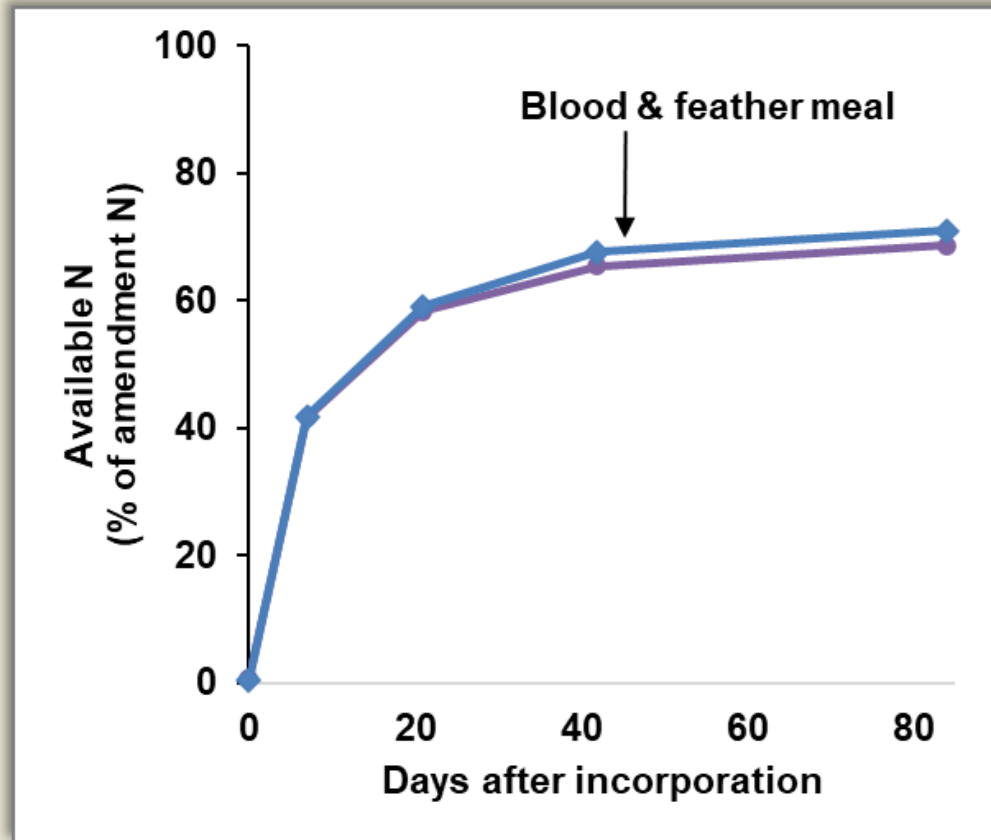


Slaughter waste products

- Blood, feather, fish, bone meals
- High N (mostly protein), often low P, K
- Bone meals=lower N, high P, Ca
- Low mineral N initially, but released quickly
- Blood, fish meals can be soluble



Slaughter products N release



Granular blends/ guano

- Blends of other organic materials
- Often treated to increase microbial availability
- May contain significant amounts of available N initially
- Guano— high N and P, readily available



4-4-2

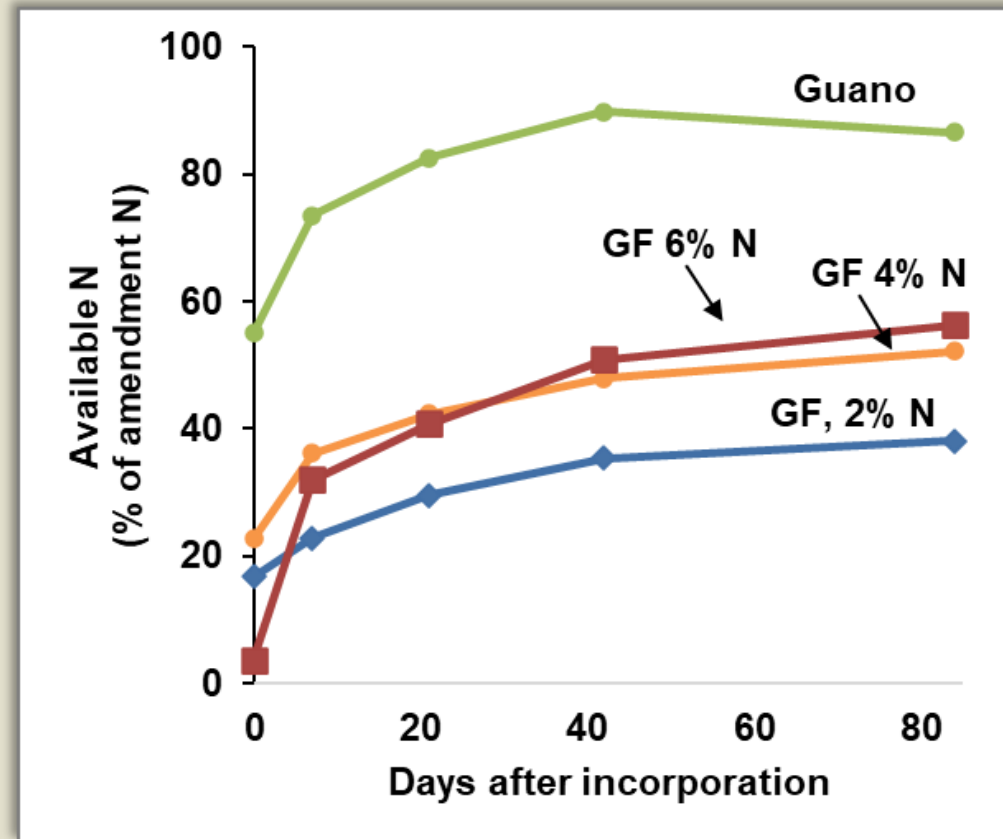
Guaranteed Analysis	
Total Nitrogen (N).....	4.00%
0.40% Ammoniacal Nitrogen	
0.03% Nitrate Nitrogen	
1.50% Other Water Soluble Nitrogen	
2.07% Water Insoluble Nitrogen	
Available Phosphate (P ₂ O ₅).....	4.00%
Soluble Potash (K ₂ O).....	2.00%
Calcium (Ca).....	7.000%
Magnesium (Mg).....	0.700%
0.70% Water Soluble Magnesium (Mg)	
Sulfur (S).....	1.50%

Derived From:
Chicken Manure, Raw Fish, Elemental Sulfur

ALSO CONTAINS NONPLANT FOOD INGREDIENTS

Soil Amending Ingredients:
5.00% Volcanic Ash

Granular blends/ guano N release



GF= Granular fertilizer

Liquids

- Often fish, plant, guano-based
- Pretreated to increase availability
 - “hydrolyzed” - pretreated with enzymes
 - “emulsion”—heated

Liquid 4-1-1 Organic Organic

Guaranteed Analysis

Total Nitrogen (N)	4.0%
3% Water Soluble Nitrogen	
1% Water Insoluble Nitrogen	
Available Phosphate (P ₂ O ₅).....	1.0%
Soluble Potash (K ₂ O).....	1.0%

Liquid 4-1-1 Hydrolyzed Fish Fertilizer Hydrolyzed Fish

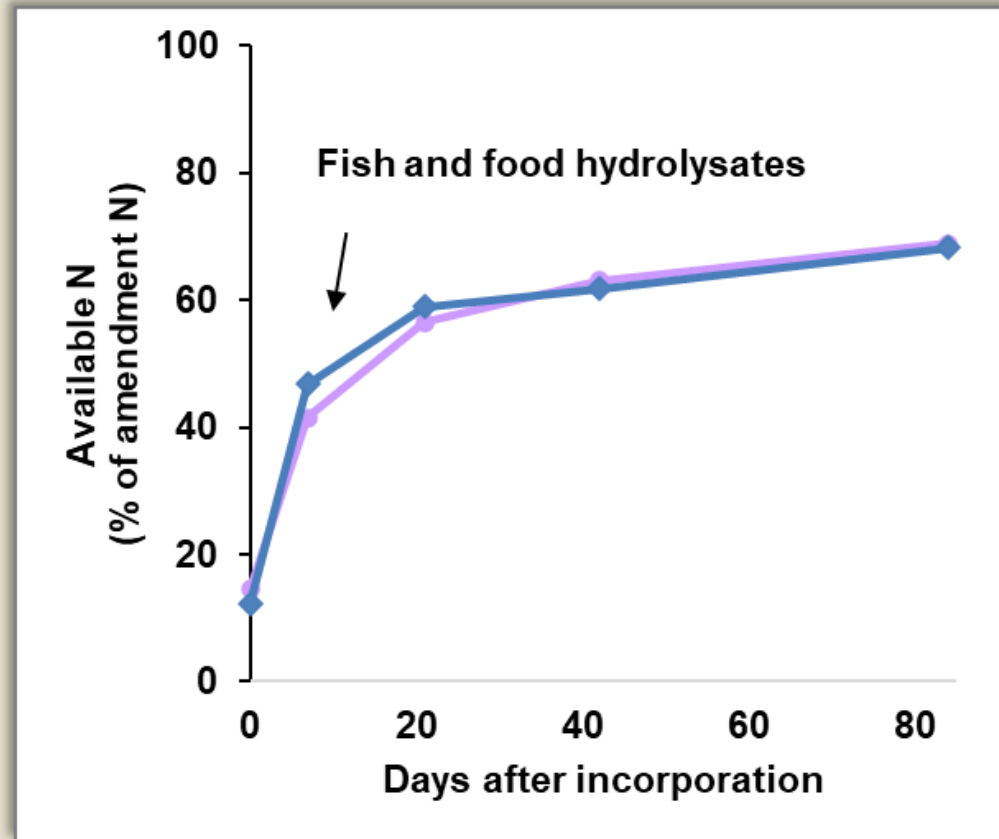
Directions: Circulate well before using. Mix a minimum of 5 parts water to 1 part H.F.F. (Mix 1 to 1 with water when injecting through a pivot). When applying with fertilizers or herbicides, mix in H.F.F. last.

Applications: Can be applied all ways to soil or foliar fed at every stage of growth. Apply 1 to 8 gallons per acre, per application. Can be used as a starter fertilizer at rates up to 4 gallons per acre.

Caution: Do not store diluted. Keep out of reach of children. Always jar test before mixing.

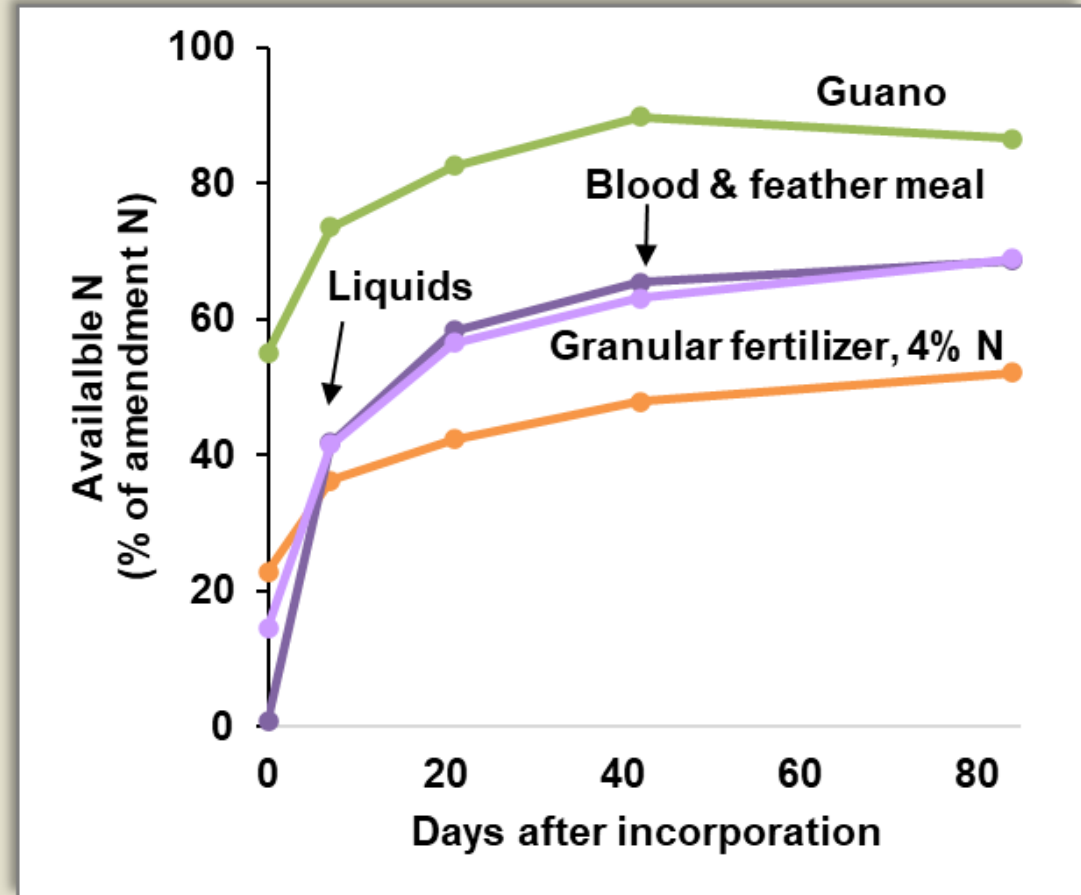
U.S. AG, LLC makes no warranties of any kind, express or implied with respect to CleanGreen Liquid 4-1-1 Manufacturer's and seller's obligation limited to replacement of product for defective material only. Neither seller or manufacturer shall be liable for any injury, loss or damage directly or consequently arising from the misuse or inability to use the product.

Liquids N release



N availability: summary

Material	Typical %N	Typical C:N ratio	N available after 12 weeks	Releases in:
Granular fertilizers (except guano)	2 - 7	5 - 7	38 - 60%	Days-weeks
Blood & feather meal	13 - 15	3 - 4	65 - 70%	Days
Liquid fertilizers	2 - 4*	4 - 6	50-100%	Days
Guano	12 - 13	3 - 4	80-90%	Days

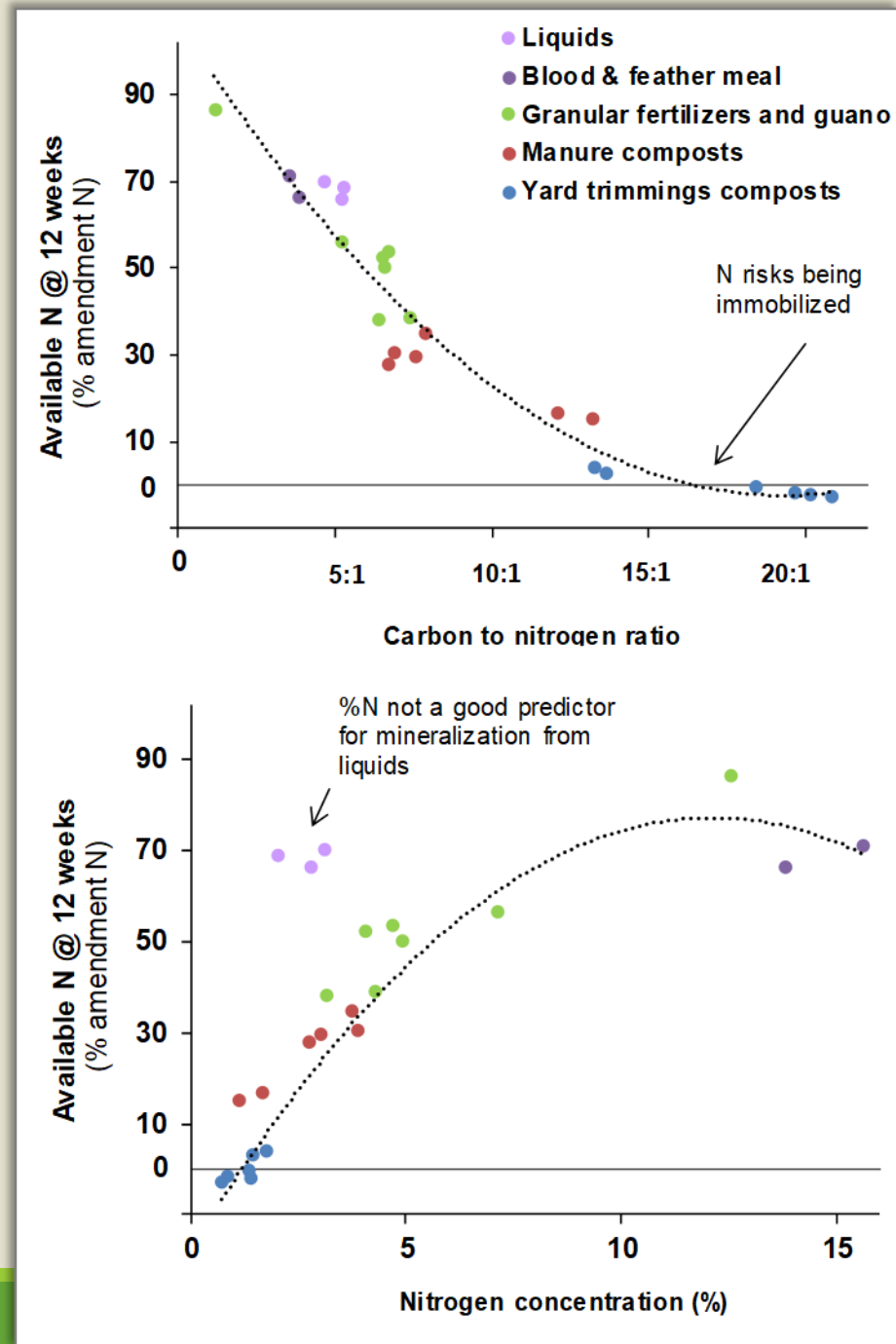


Factors affecting N availability

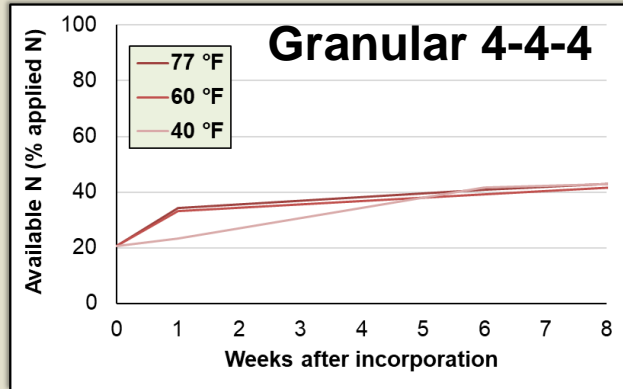
- Chemistry
- Temperature
- Placement

Fertilizer quality

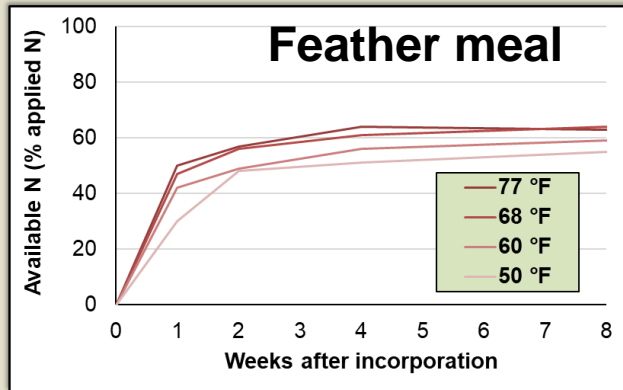
- C to N ratio
- Percent N
- Moisture content matters



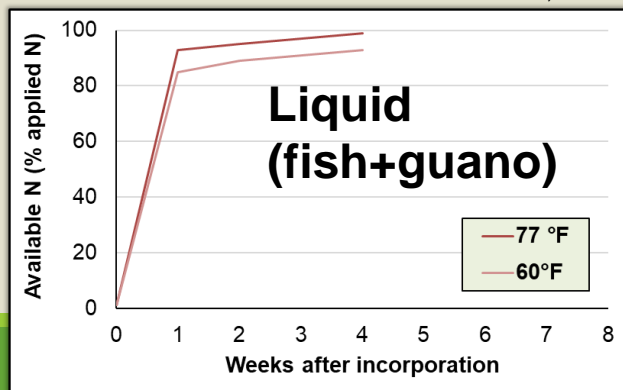
Temperature



Lazicki, Lloyd and Geisseler, unpublished data



Hartz and Johnstone, 2006



Hartz et al., 2010

- **Slower** @ cold temps (1-2 week delay)
- Total available N slightly **lower** @ colder temps (~10-15%)
- Very little effect for liquid fertilizers
- Colder → delay in nitrification (ammonium: less risk of leaching, slightly less available to plants)

Placement

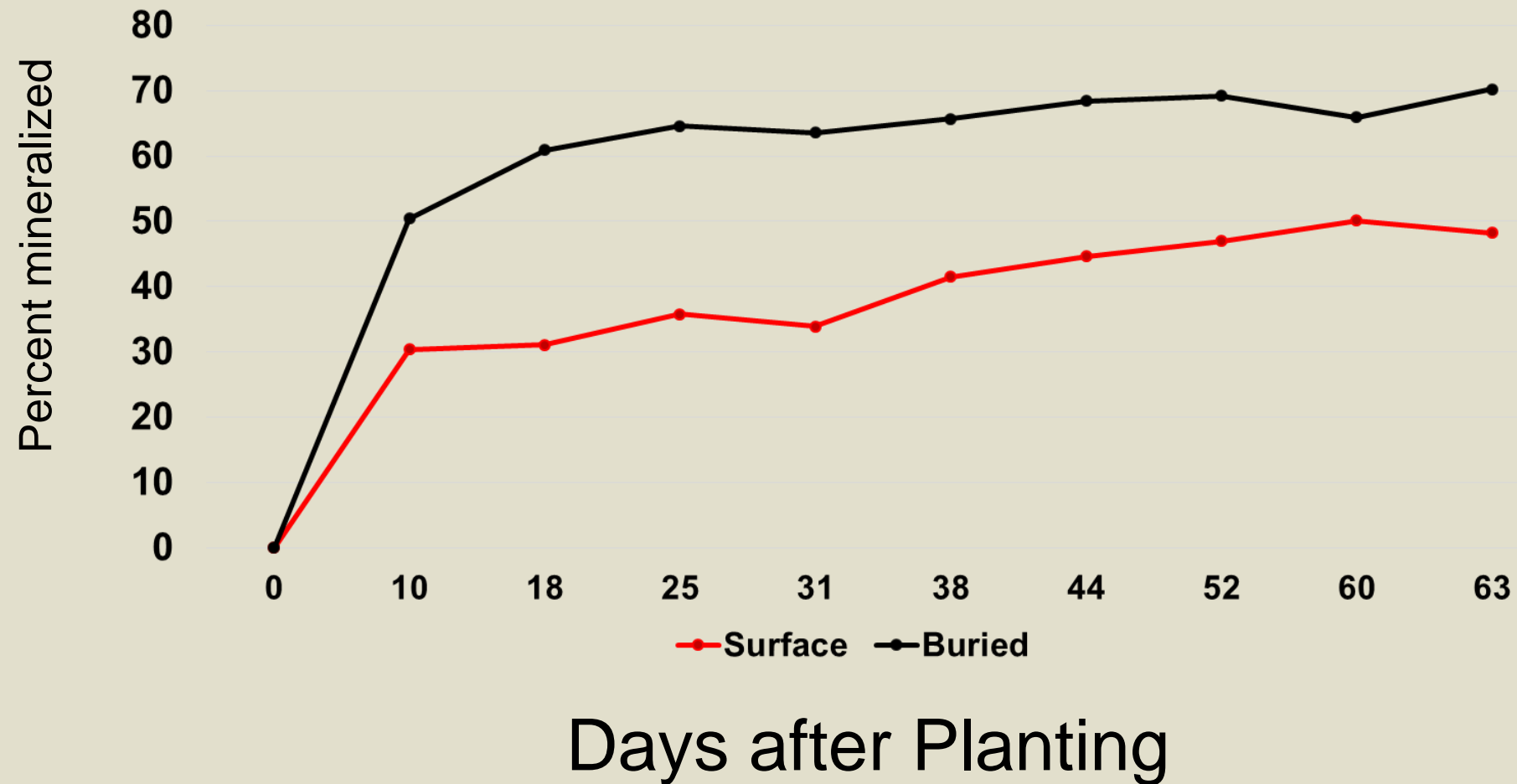


Buried in soil



Place on top of soil

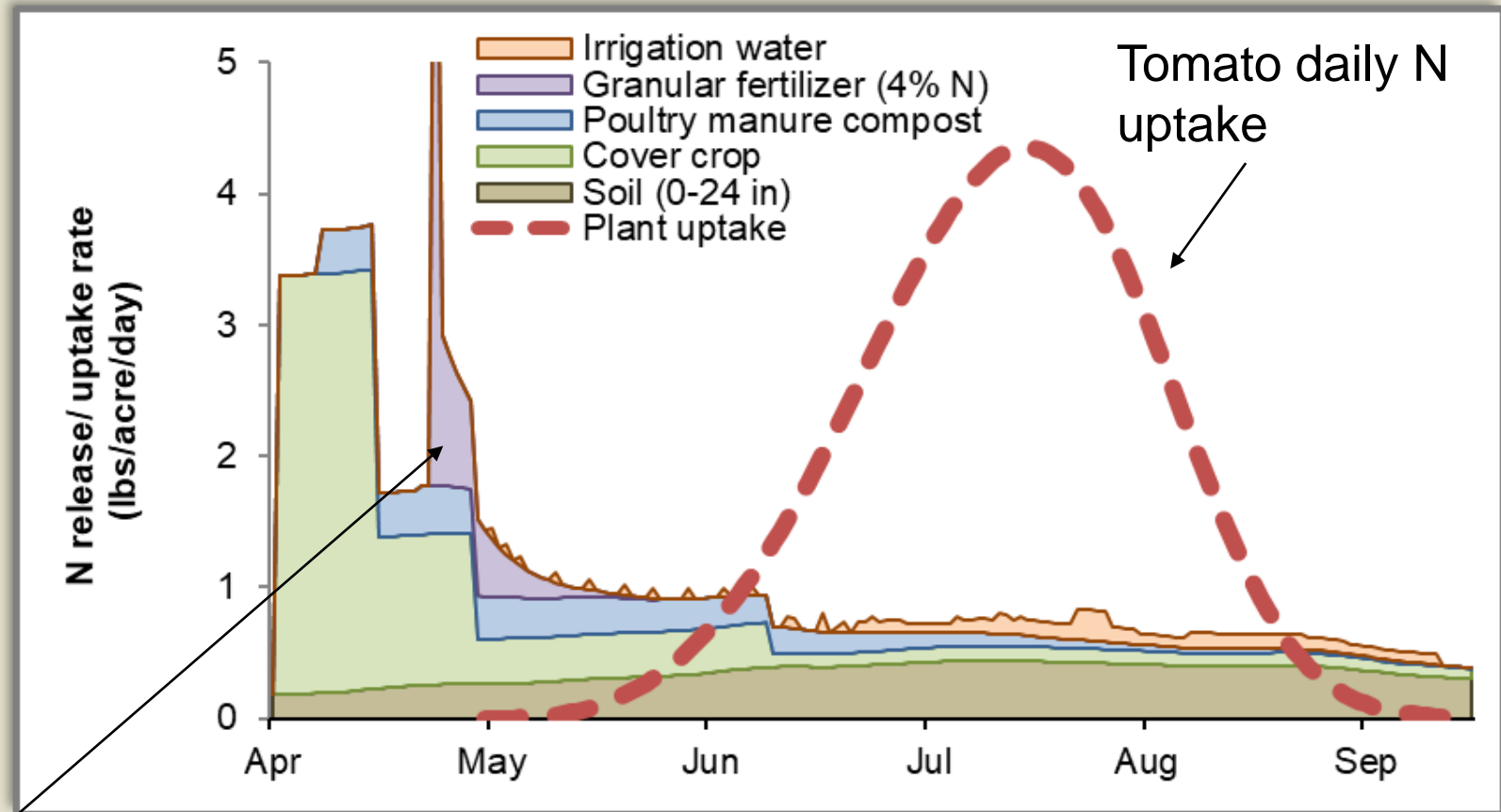
Percent N Mineralized from Pouches Buried vs Surface (4-4-2)



Summary : Estimating Available Fertilizer N

- **Chemistry**– Use fig. 8 (pp 21) to get an estimate of N release based on %N or C:N ratio
- **Temperature**– Reduce slightly (~10-15%) for more complex materials applied in cold weather
- **Placement**– Reduce by ~30-50% for surface placement (more if high initial NH_4 , dry conditions)

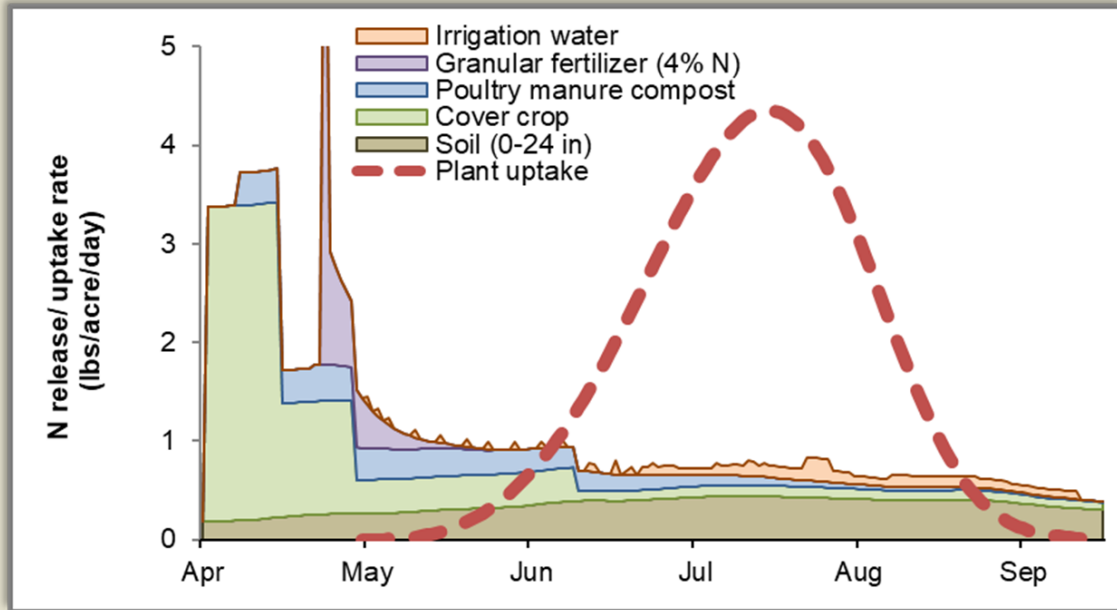
Optimize fertilizer timing



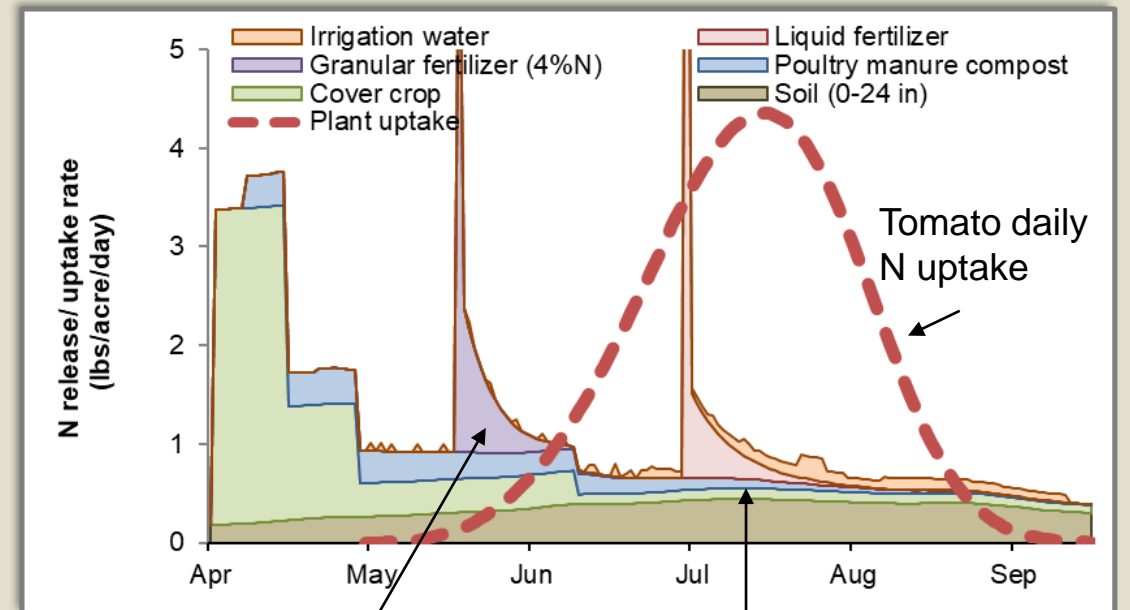
Preplant application of granular fertilizer
(30 lbs N/acre)

Optimize fertilizer timing

Preplant



Sidedress



Sidedress application of granular fertilizer (30 lbs N/acre)

Midseason water-run application of liquid fertilizer (20 lbs N/acre)

Thank you!

More info at:

<https://access.onlinelibrary.wiley.com/doi/full/10.1002/jeq2.20030>

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Nitrogen mineralization from organic amendments is variable but predictable

Patricia Lazicki  Daniel Geisseler, Margaret Lloyd

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Assigned to Associate Editor Mustafa Uktasoglu