

Cover Crop Fertility

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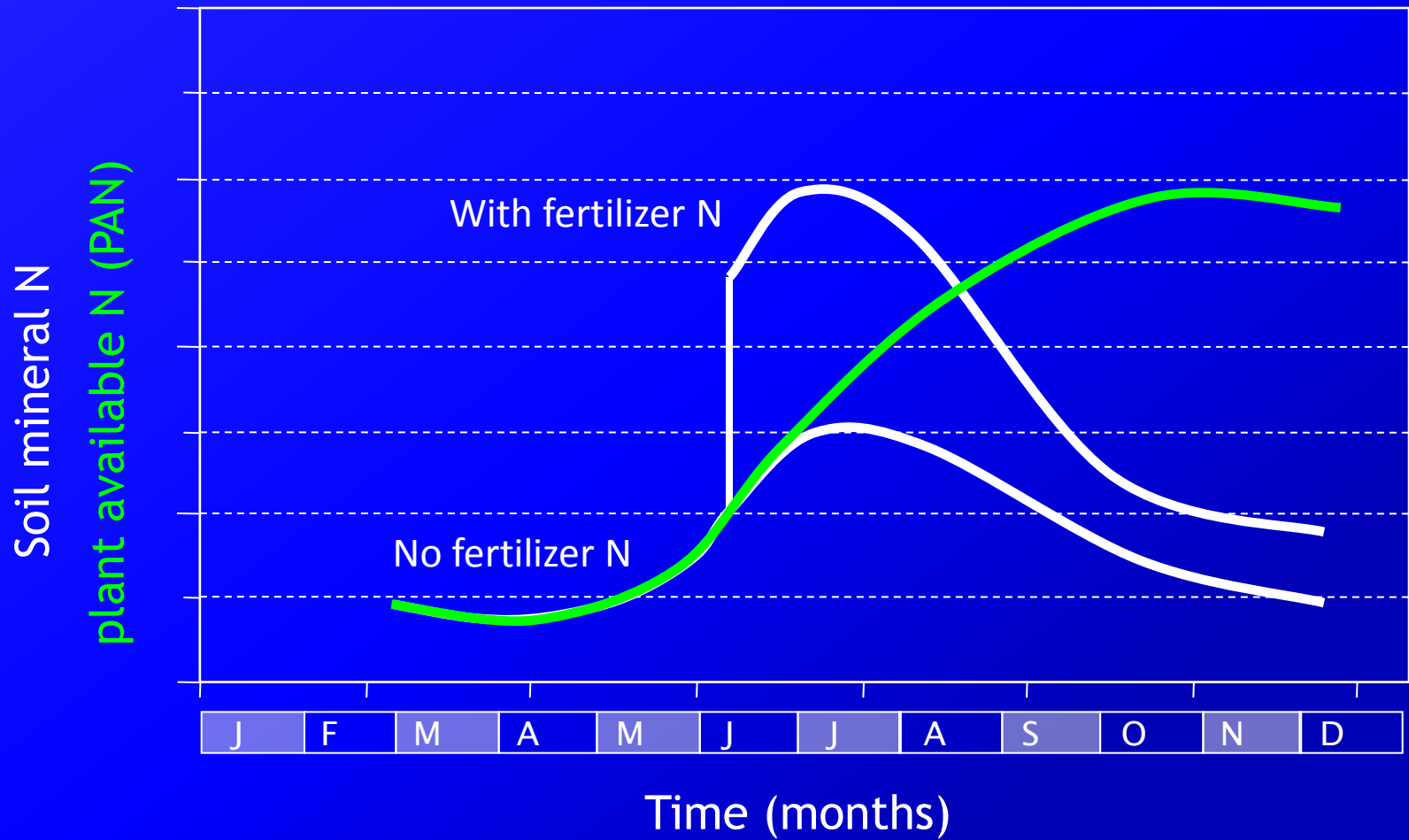
Cover Crops and Plant Nutrients

- Nitrogen scavenging
- Nitrogen source
- Cover crops also require plant nutrients for growth

Essential Plant Nutrients

- Macro- vs micronutrients
- Macronutrients (needed in large quantities)
 - Carbon, Hydrogen, and Oxygen
 - Nitrogen, Phosphorus, and Potassium
 - Calcium, Magnesium, and Sulphur (These are often called secondary nutrients)
- Micronutrients (needed in small quantities)
 - Iron, Manganese, Molybdenum. Boron, Zinc, Chloride, Cobalt, Nickel

Typical change in soil mineral N levels in a unfertilized field in Ontario



Fall cover crop biomass production as influenced by manure N application rate

Cover crop species	Manure N application rate (kg N ha ⁻¹)		
	0	134	266
	Cover crop biomass (kg ha ⁻¹)		
Red clover*	2180 a ⁺	1965 a	2355 a
Oilseed radish	565 a	1085 ab	1290 b
Perennial ryegrass	1180 a	2250 b	2700 b
Oats	1340 a	2390 b	2520 b

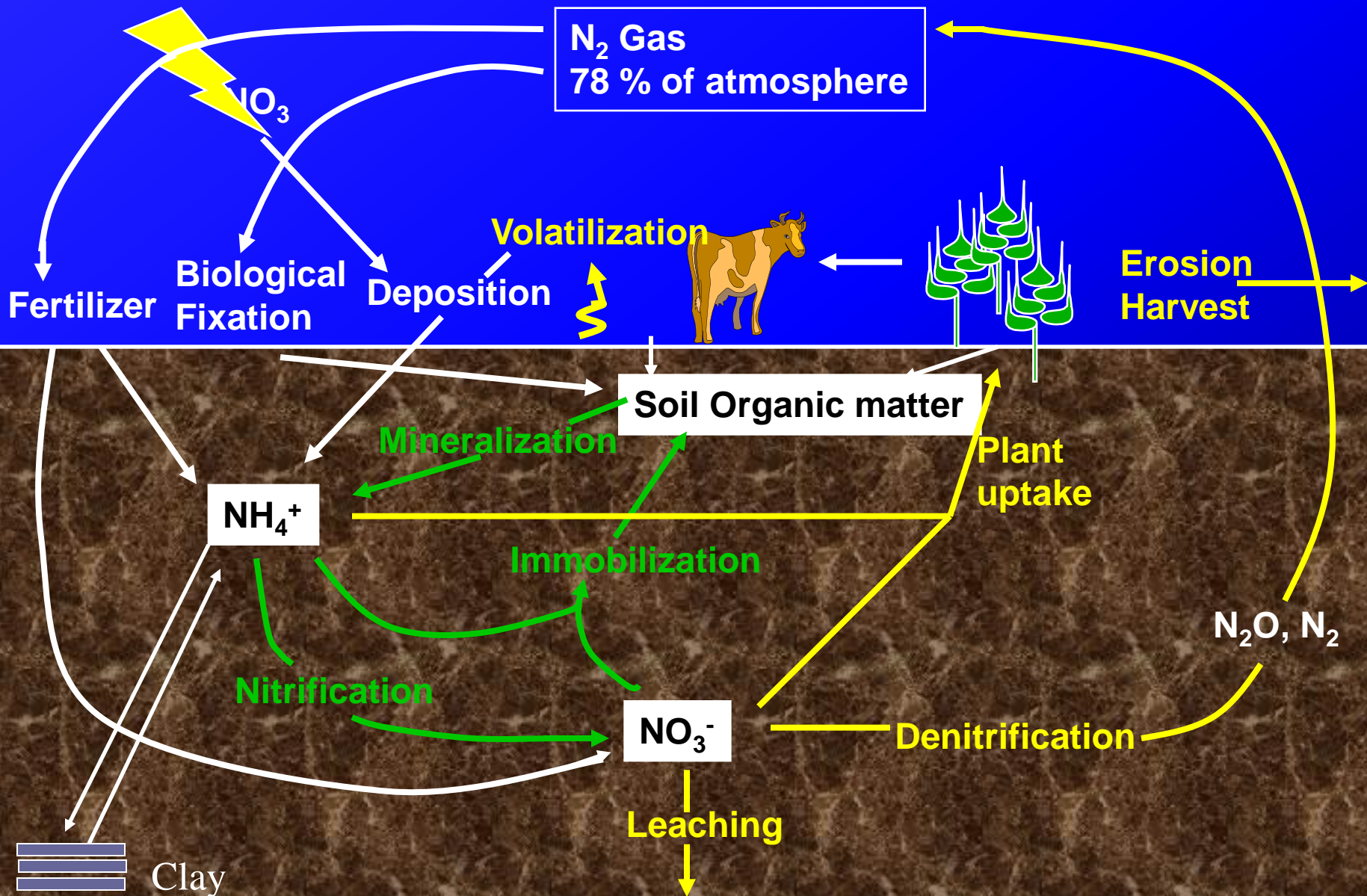
* Average of fall and spring control plots

+ Values with different letters are significantly different (P < 0.05)

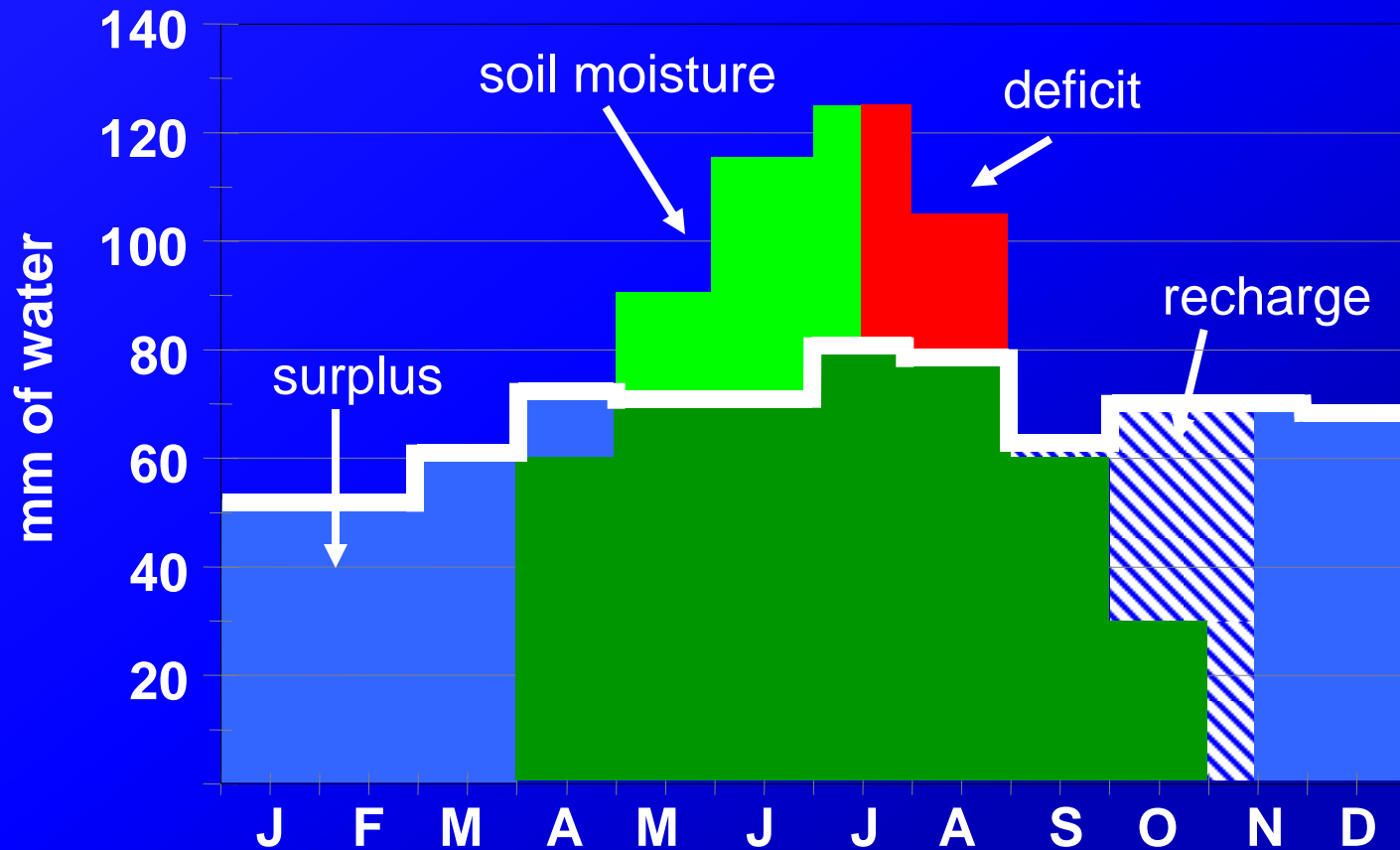
N Scavenging



Nitrogen Cycling



Typical Water Budget for Ontario



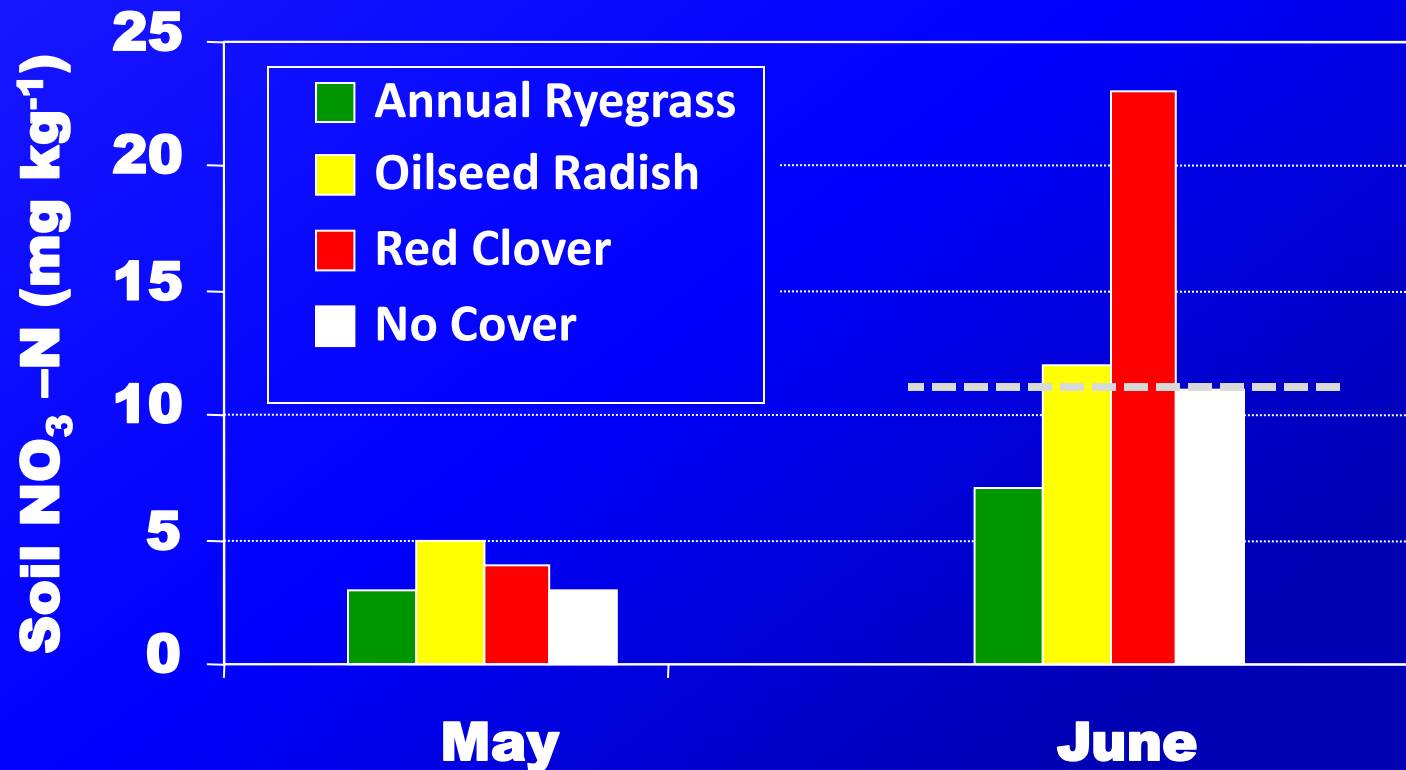
End of Season Cover crop N Content and Biomass

Crop	Plant N	Plant Mass
	(kg ha ⁻¹)	
Annual Rygrass	33 a	2530 a
Oilseed Radish	55 b	3680 b
Red Clover	45 ab	2870 a

Nitrogen Supply to Following Crop



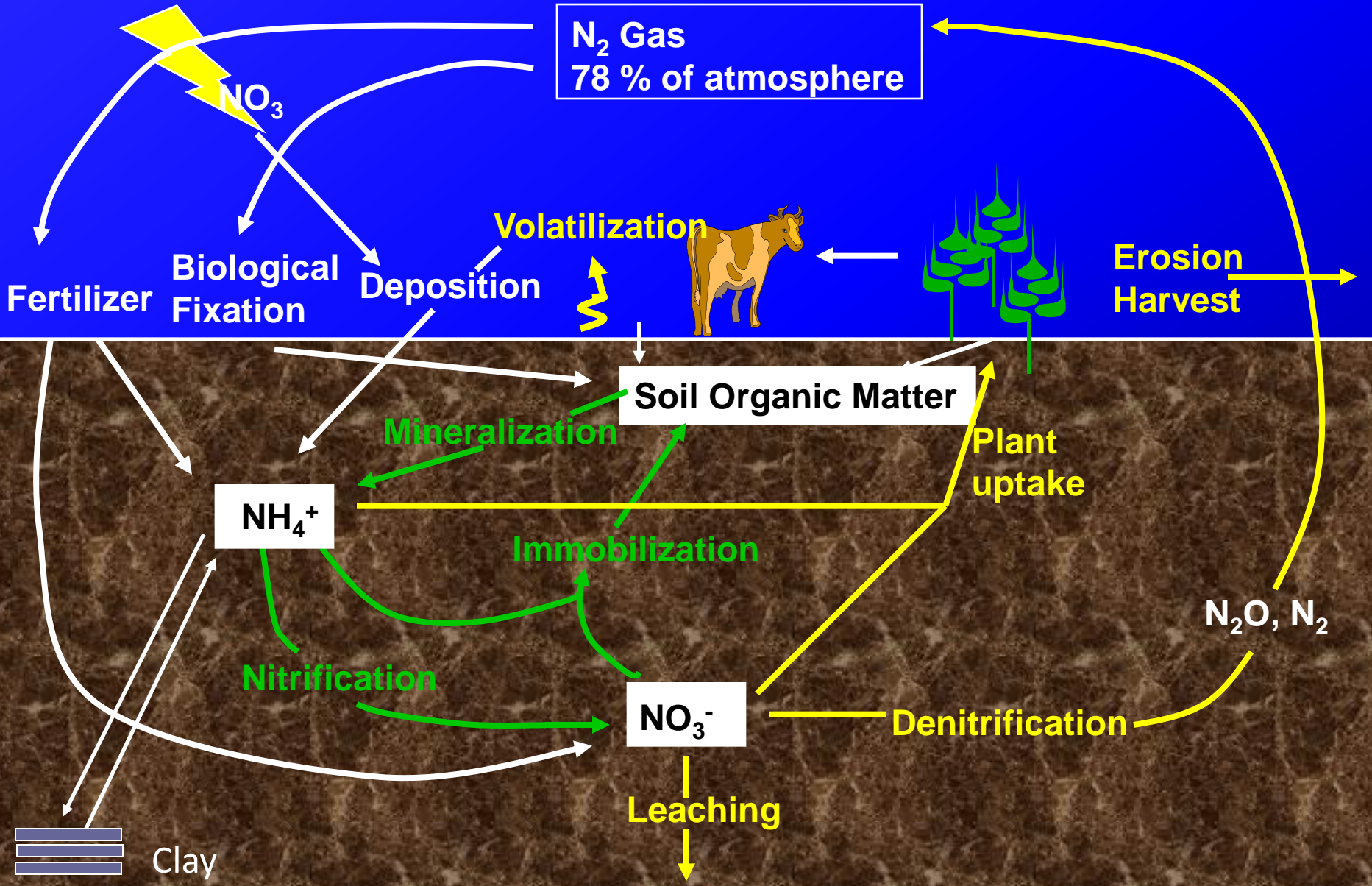
Cover Crop Effects on following May – June Soil NO₃-N Concentrations



Grain N Content and Yield as influenced by Cover Crop

Crop	Plant N	Yield
	(kg ha ⁻¹)	
Annual Rygrass	63 a	6770 a
Oilseed Radish	123 b	9520 b
Red Clover	142 c	10670 c
No Cover	110 b	9130 b

Nitrogen Cycling



Mineralization - Immobilization

When organic residues are decomposed in the Soil, N can either be released (mineralization) or used from the soil (immobilization)

The Carbon/nitrogen ratio of organic materials added to the soil largely influence which will occur

C:N Ratio and N Release During Early Decomposition

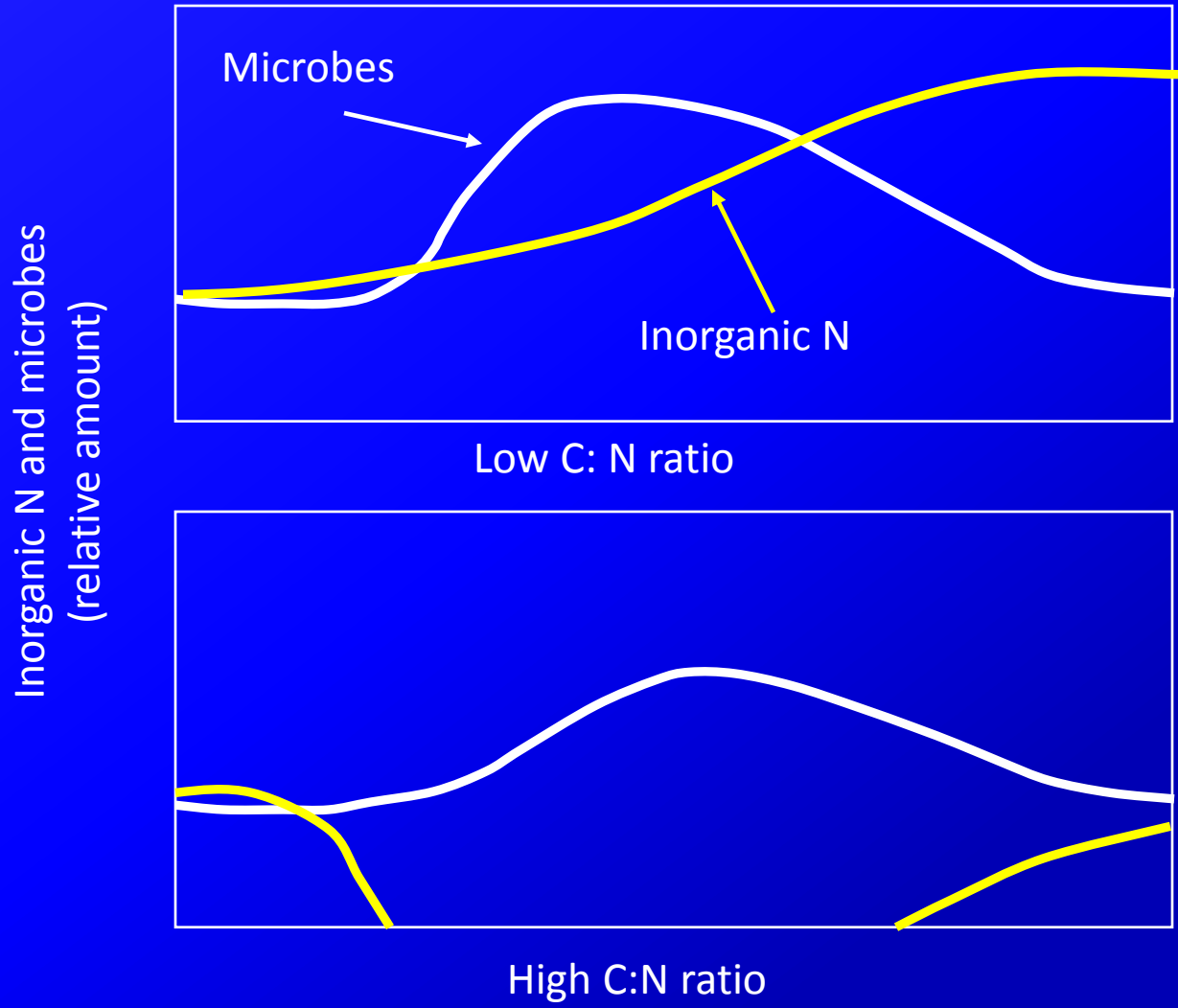
C:N ratio $< 25:1$ = mineralization

C:N ratio $> 25:1$ = immobilization

C:N Ratio of soil microbes $\cong 8:1$

How can something with a C:N ratio of 8:1 get enough nitrogen from organic material with a C:N ratio of 25:1?

Mineralization - Immobilization



Factors Impacting the Carbon to Nitrogen Ratio

- Plant species
- Plant age
- Soil nitrogen availability
- Plant part

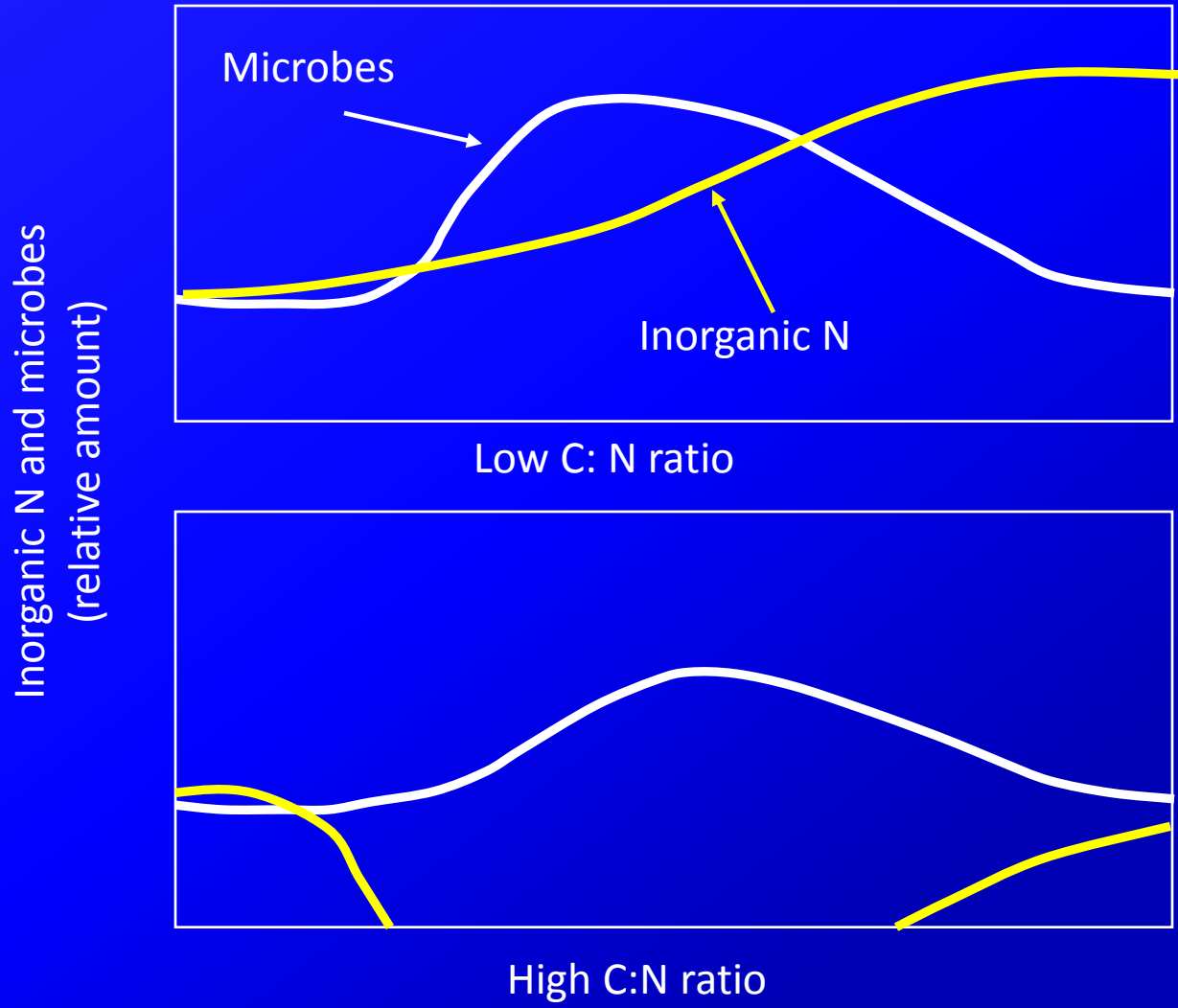
Carbon:Nitrogen Ratio

Soil Microbes	4:1 to 9:1
Soil Organic Matter	10:1 to 12:1
Corn Stalks	60:1
Wheat Straw	80:1
Solid Cattle Manure	20:1 to 40:1
Sawdust	500:1
Hairy Vetch cover crop	11:1
Red Clover	15:1
Oilseed radish	20:1
Rye vegetative	26:1

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Mineralization - Immobilization



Factors Influencing the Rate of Decomposition of Organic Matter

- Type of organic matter
- Size of organic matter
- Amount of mixing in the soil
- Temperature
- Moisture
- Oxygen status
- Soil pH
- Nutrient content

Managing Nutrient in a Cover Crop System

- Cover crop choice is largely dependant on you objectives
- Non –legume cover crops may not have sufficient nitrogen
- Timing is critical for recovering N from cover crops