

Nitrogen Mineralization of Organic Amendments

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Nitrogen Supply - Organic Farms

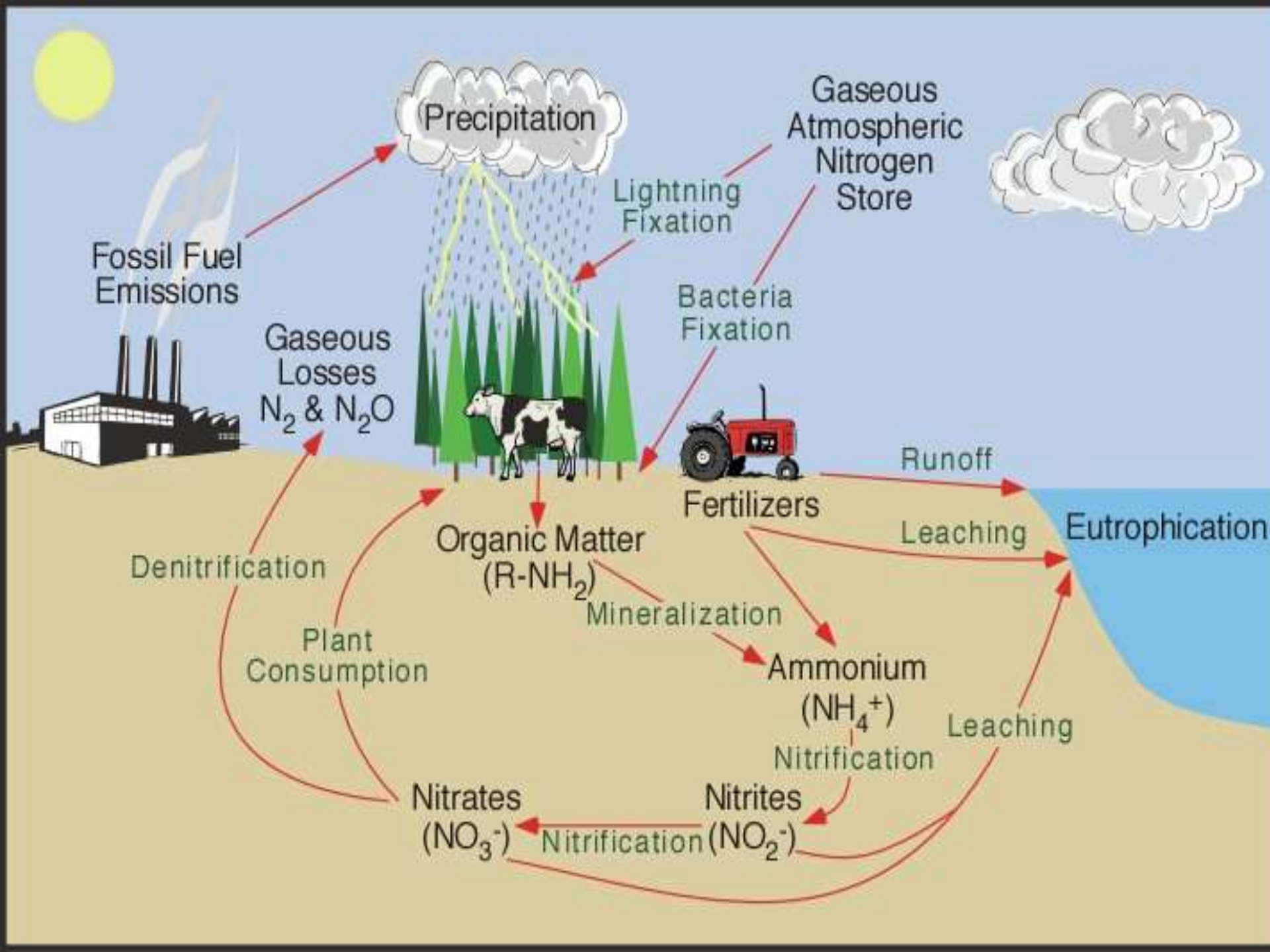
- Backbone – Building Soil Organic Matter
 - N-fixed through legumes
 - Animal manure/composts
 - Organic fertilizers



Soil Nitrogen

- **Organic Nitrogen (SOM)**
 - slowly available to crops
 - microbes required

- **Inorganic Nitrogen**
 - rapidly available - Plant Available Nitrogen
 - ammonium ion (NH_4^+) and nitrate (NO_3^-)



Mineralization



(Soil Temp. > 50 degrees F)

Air, Moisture, Nice Home!

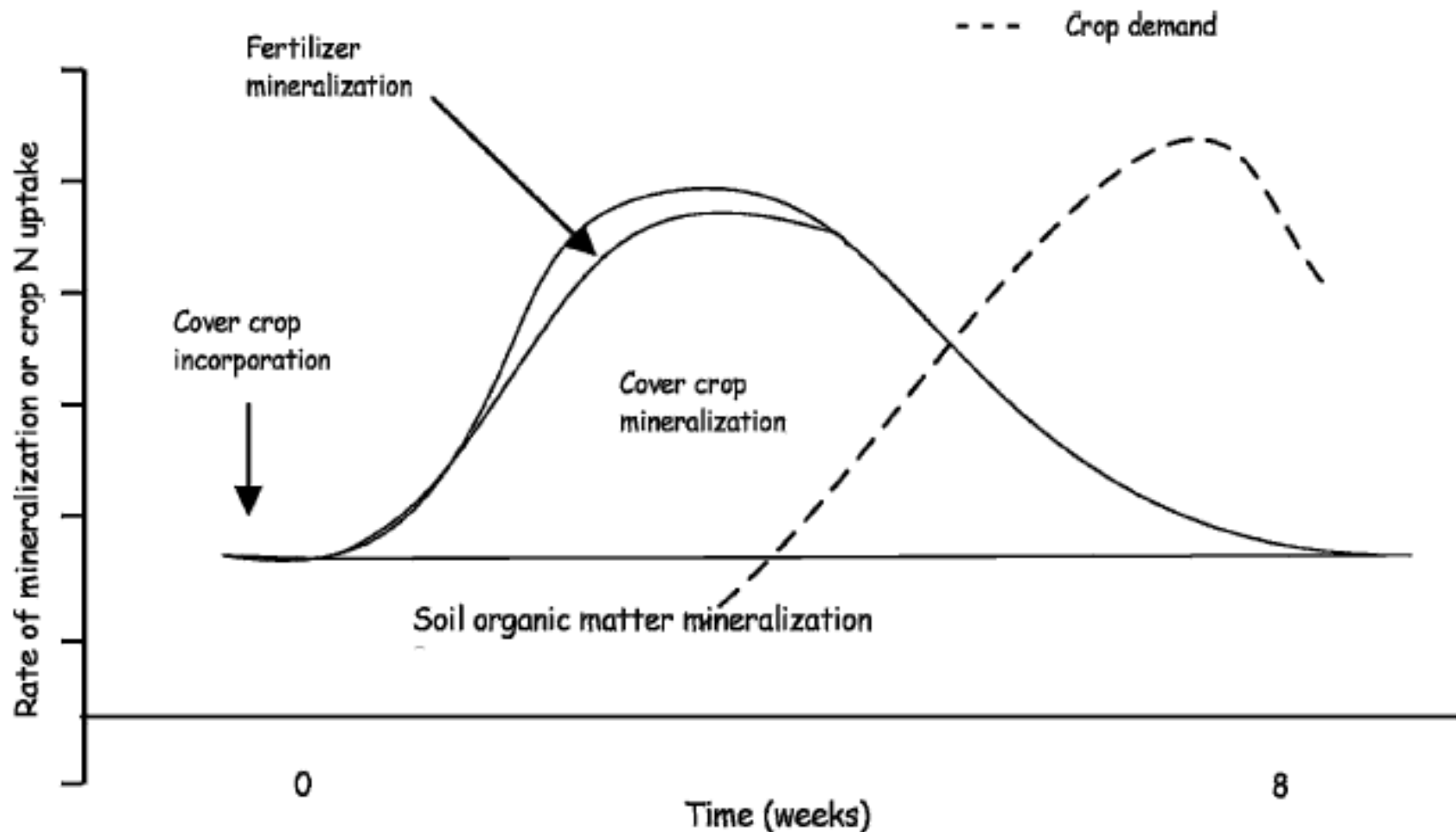


Fig. 2. Timing of nitrogen (N) mineralization from soil organic matter, cover crop residue, and organic fertilizer in relation to crop N uptake (from Gaskell et al., 2006).

Organic Fertilizers

Byproducts of Fish, Livestock, or Food

Table 1. Common organic nitrogen (N) fertilizer materials and their nutrient analysis.^z

Material	Nitrogen (% N)	Phosphorus (% P)	Potassium (% K)
Fish meal or powder	10–11	1.3	<1
Pelleted chicken manure	2–4	<1	<1
Processed liquid fish residues	4	<1	<1
Feather meal	12	0	0
Seabird and bat guano	9–12	<1–1.75	<1
Alfalfa meal (<i>Medicago sativa</i>)	4	<1	<1
Soybean meal (<i>Glycine max</i>)	7	<1	<1
Bone meal	2	<1	0
Kelp (order Laminariales)	<1	0	1.7
Chilean nitrate	16	0	0
Blood meal	12	0	0
Meat and bone meal	8	2.2	<1

^zGaskell et al., 2006.

Important Supplements

Table. 2. Mineralization rates of several typical organic fertilizer materials at two temperature regimes.^z

Product	Temp (°C) ^y	Proportion of initial organic nitrogen mineralized (%)		
		1 wk	4 wk	8 wk
Pelleted poultry manure	15	4	16	21
	25	10	23	36
Sea bird guano	15	49	57	60
	25	45	48	54
Pelleted seabird guano	15	42	61	64
	25	46	60	67
Fish powder	15	51	55	61
	25	48	60	64
Feather meal	15	42	56	59
	25	50	64	63
Blood meal	15	41	60	64
	25	51	67	70

^zGaskell et al., 2006; Hartz and Johnstone, 2006.

^y(1.8 × °C) + 32 = °F.

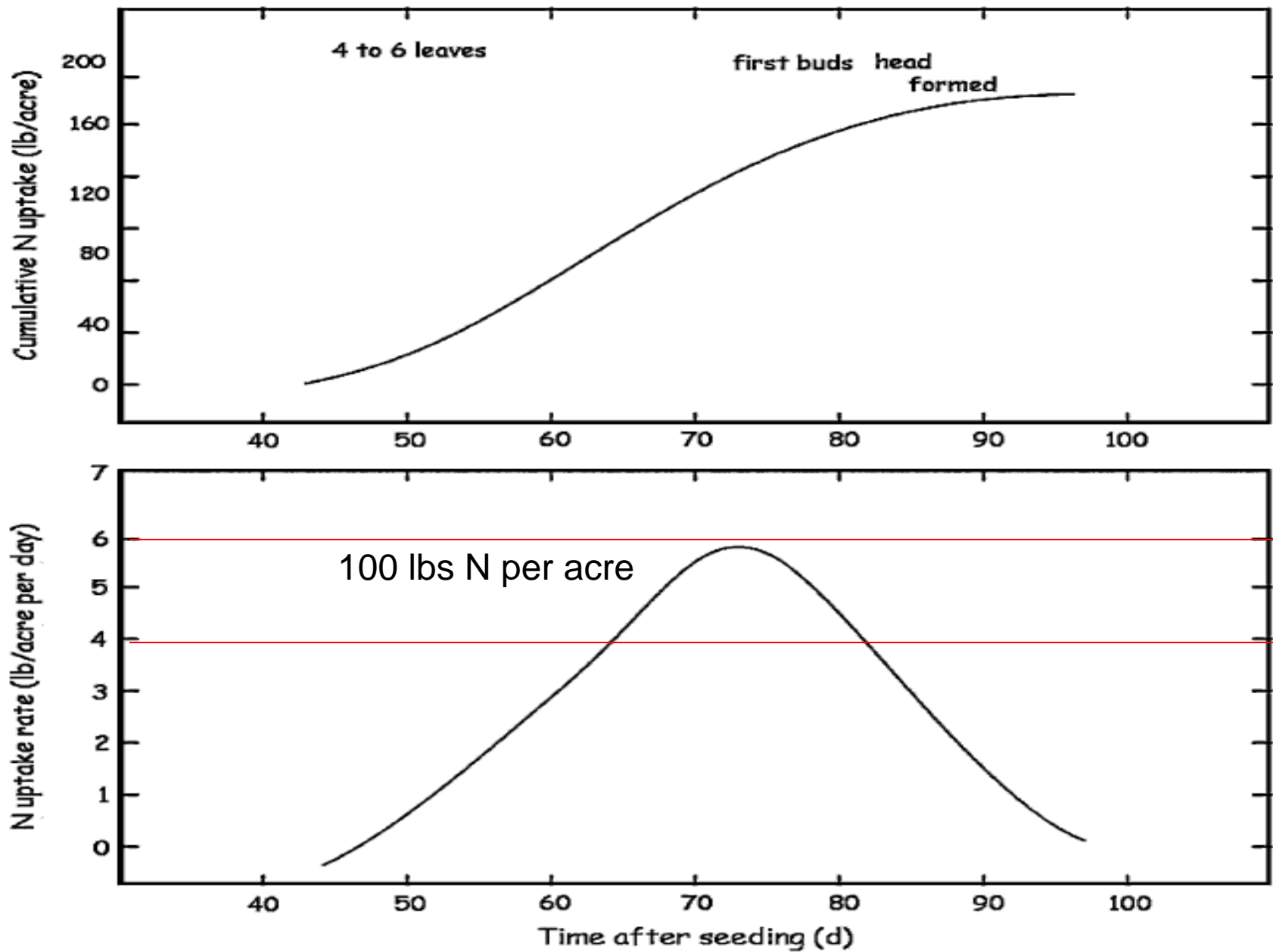


Fig. 4. Phases of broccoli crop nitrogen (N) uptake rate (lb/acre per day) and cumulative N uptake in lb/acre (1 lb/acre = 1.1209 kg·ha⁻¹) compared with broccoli biomass accumulation in ton/acre (1 ton/acre = 2.2417 mg·ha⁻¹) (Sullivan et al., 1999).

Determining Nitrogen Mineralization Rates of Locally Available Organic N Fertilizers



Incubation Study

- 2 Soil types
- 12 Fertilizers
- 1 Temperature
 - 70F
- 6 Sample dates
 - (1, 7, 14, 28, 42, 70)



	Soil A	Soil B
Soil Series	Winooski Fine Sandy Loam	Vergennes Clay
Location	Windsor, Vermont	West Addison, Vermont
Management History	Conventional continuous vegetables	Conventional soybean/corn rotation
Organic Matter (%)	1.6	5.1
pH	6.7	7.2
Available P (ppm)	35.4	7.5
K (ppm)	197	228
Mg (ppm)	108	587
Al (ppm)	18	14
Ca (ppm)	1037	4905
Zn (ppm)	0.7	0.8
Effective CEC (meq/100g)	6.6	30.0

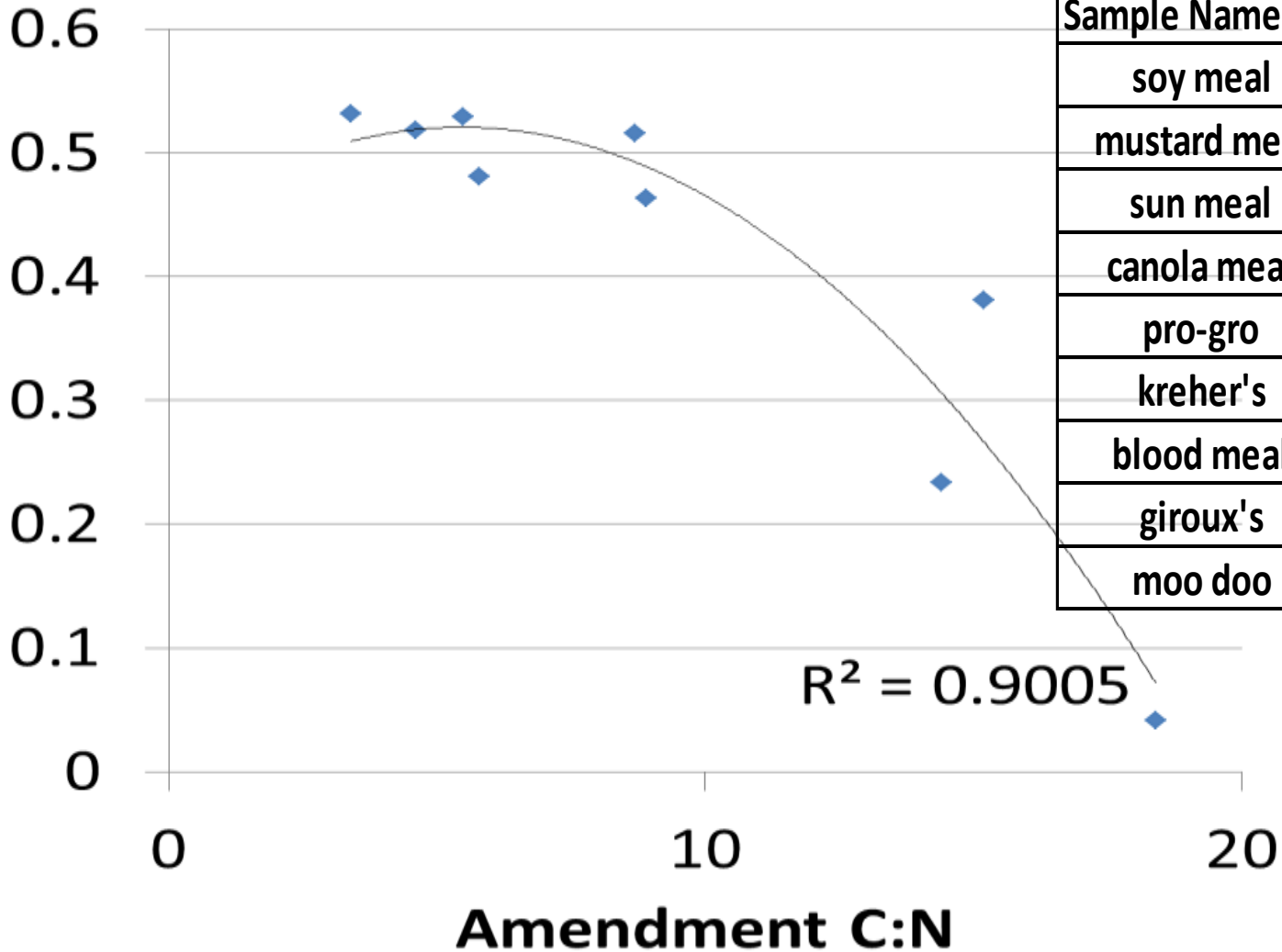
Organic Fertilizers

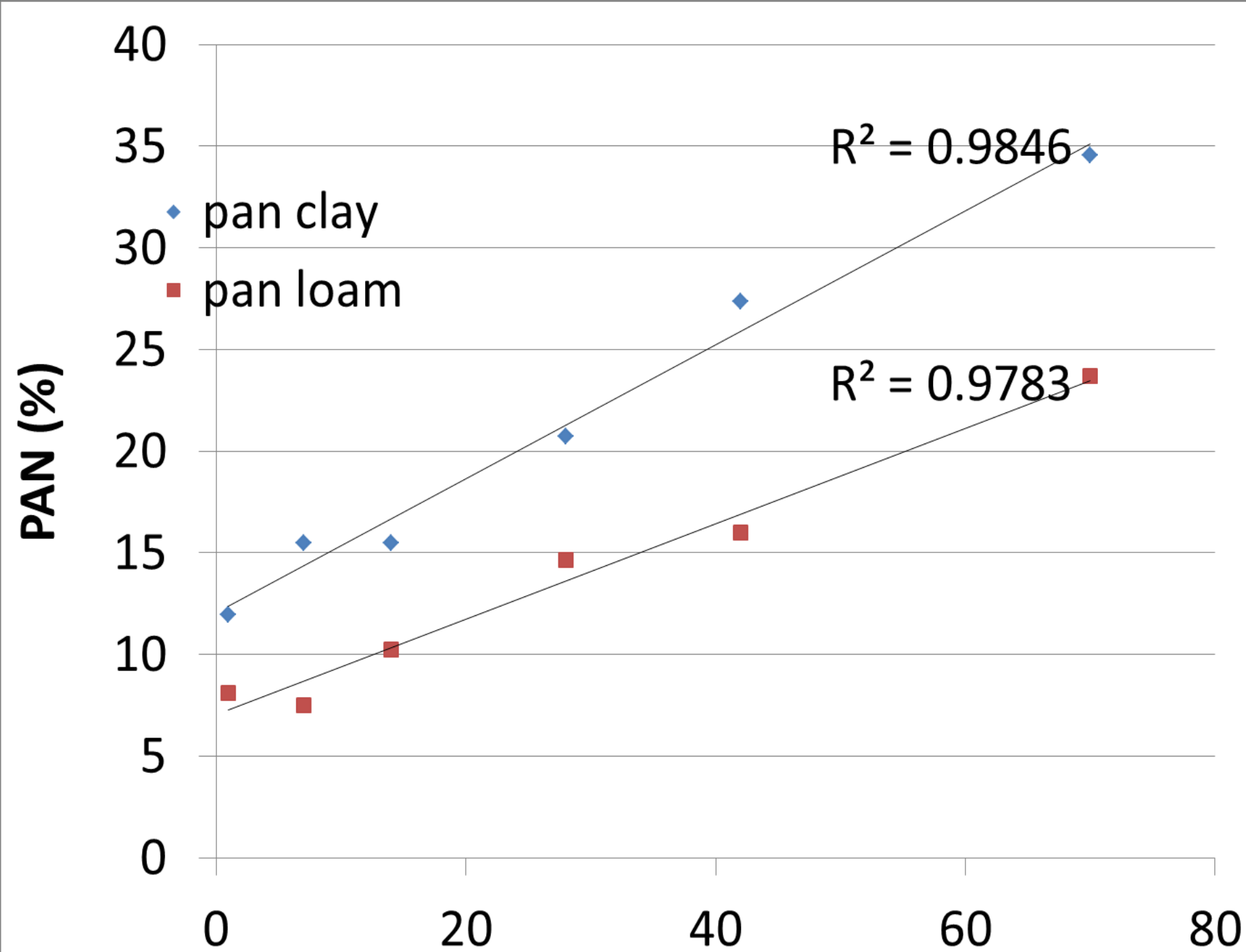
Amendment	Total C %	Total N %	C:N ratio
soybean meal	44.7	8.19	5.5
mustard meal	50.3	5.68	8.9
canola meal	48.7	5.57	8.7
pro-gro	23.1	5.07	4.6
kreher's	31.4	5.41	5.8
blood meal	51.3	15.2	3.4
giroux's	24.2	1.68	14.4
moo doo	37.0	2.01	18.4
chilean nitrate		16.0	

Feather meal, alfalfa meal, cheep cheep

C:N Ratio

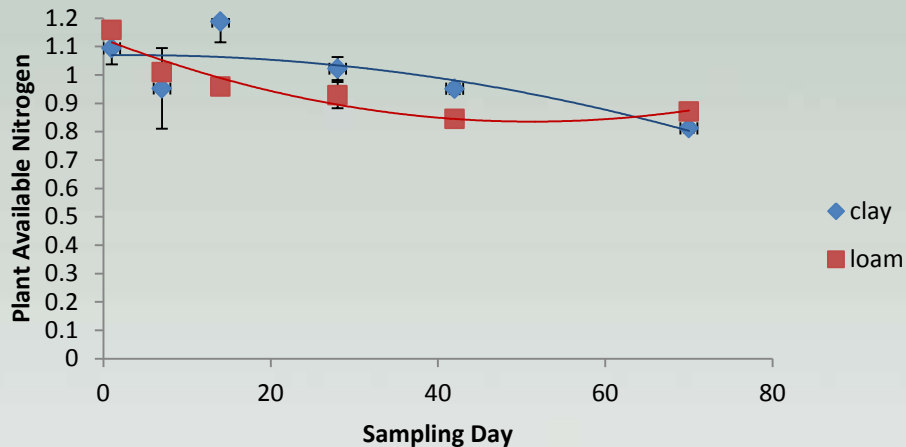
70 day Plant Available N





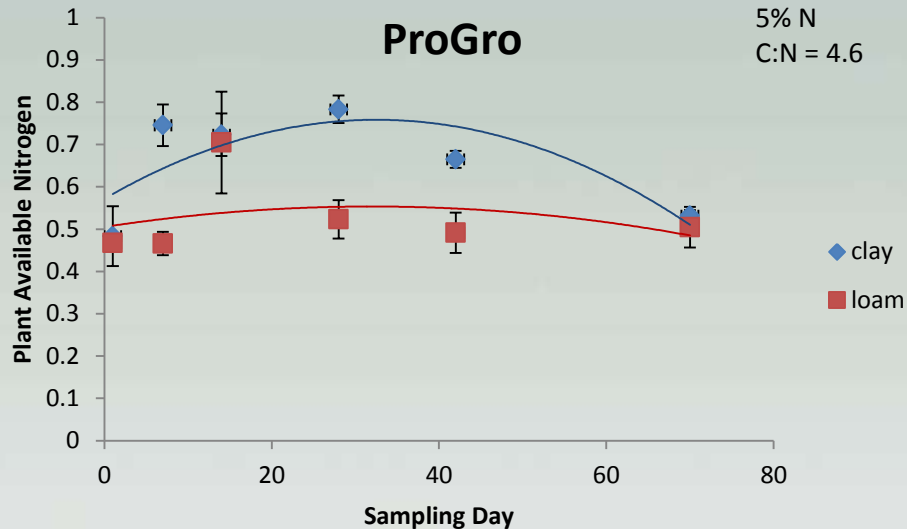
Chilean Nitrate

16% N



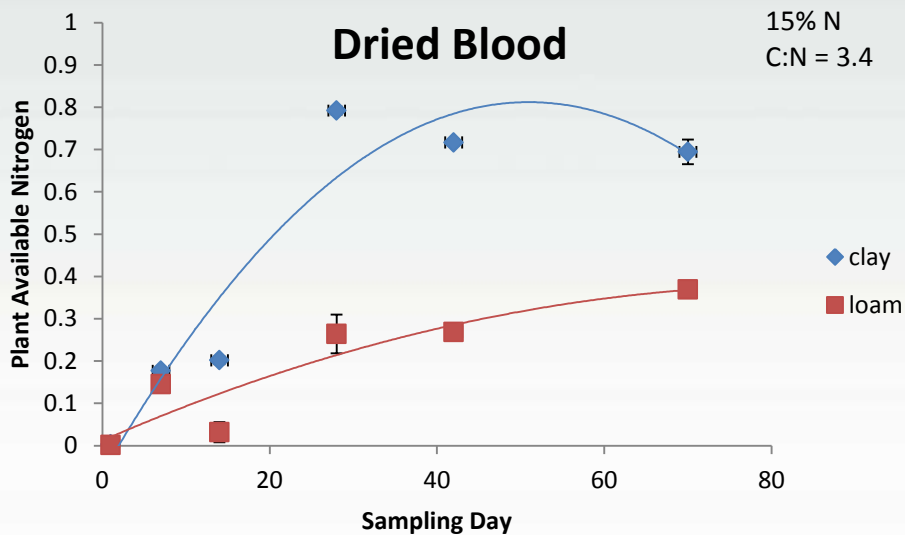
ProGro

5% N
C:N = 4.6



Dried Blood

15% N
C:N = 3.4

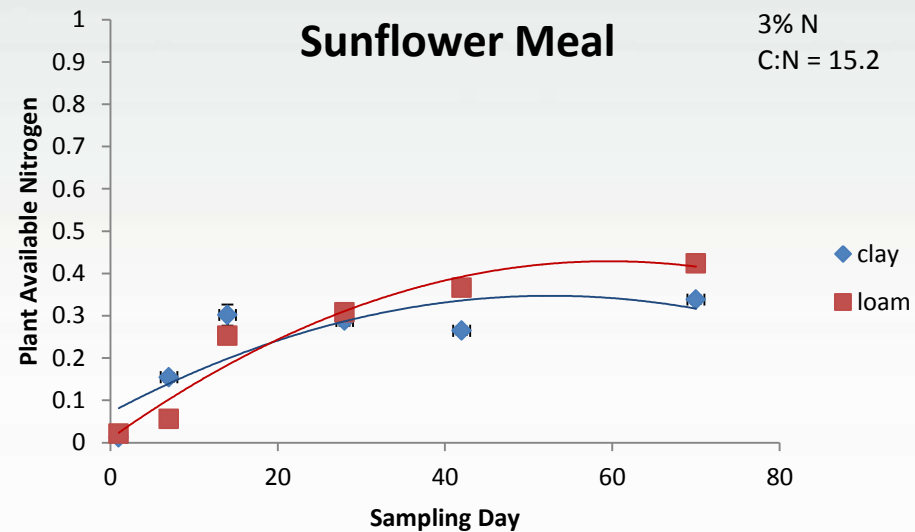
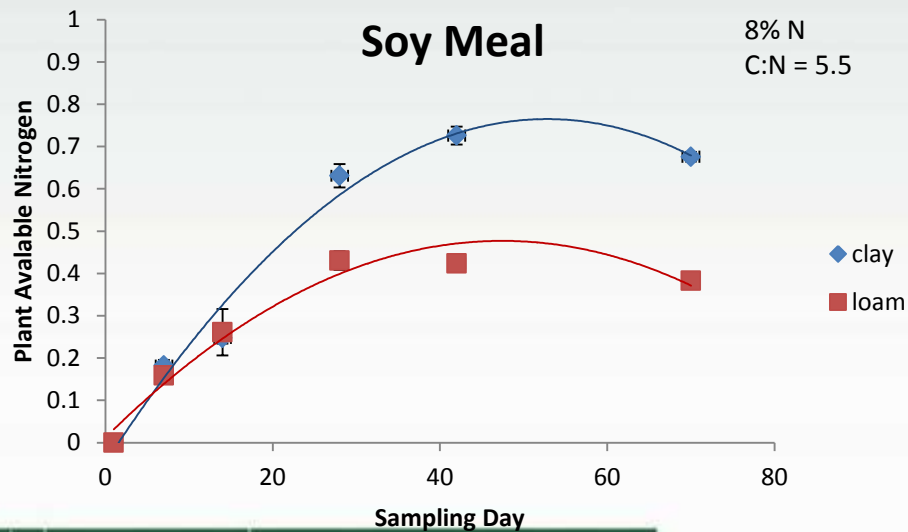
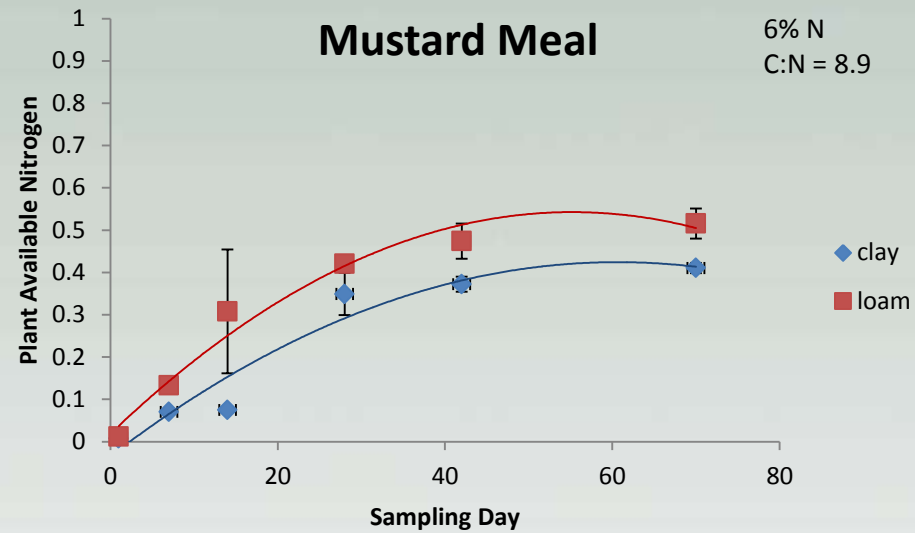
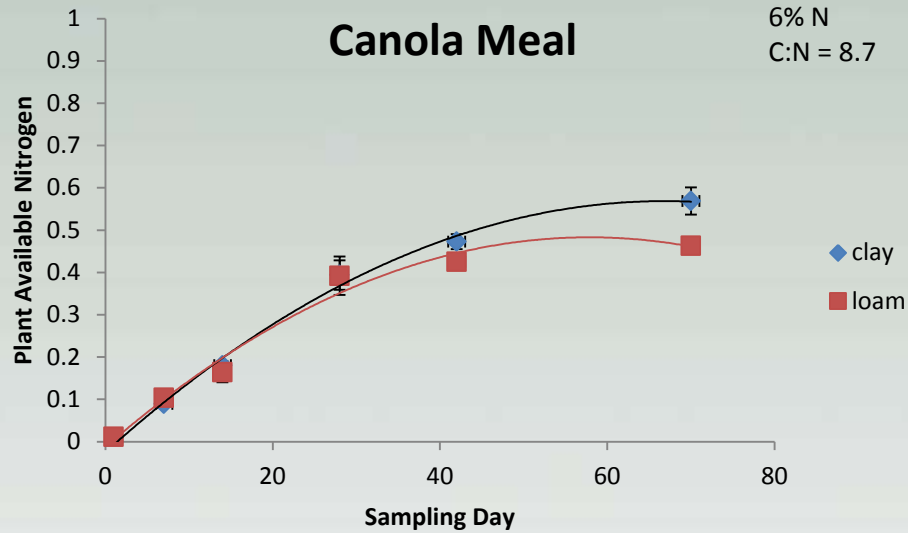


14 day

Chilean = 16 lbs N in 100

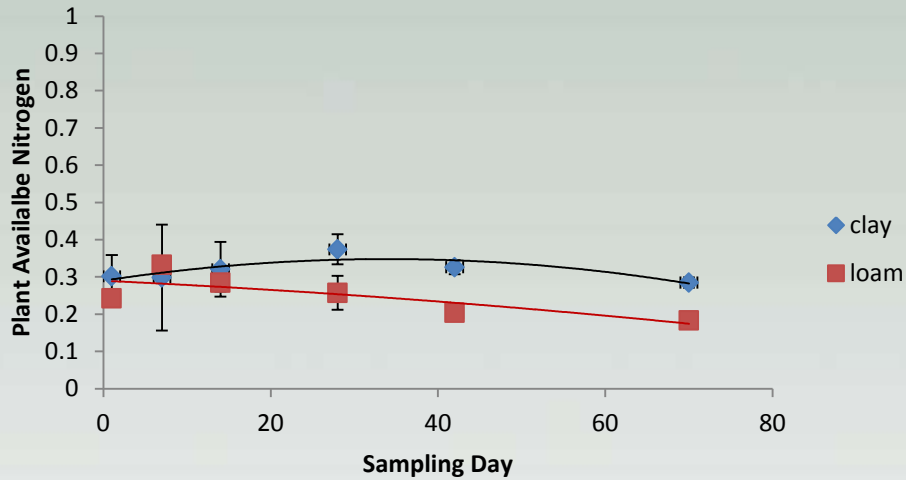
ProGro = 3.5 lbs N in 100

Blood = 3 lbs N in 100



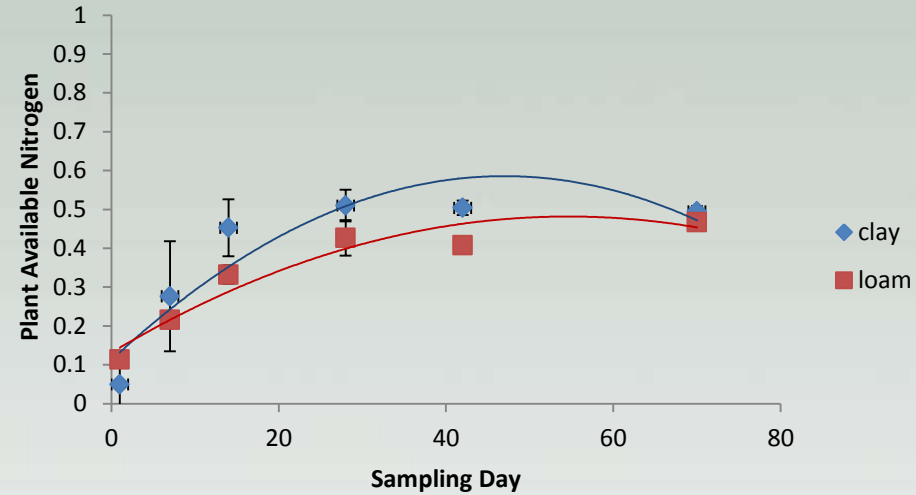
Giroux's Poultry Litter

1.7% N
C:N = 400



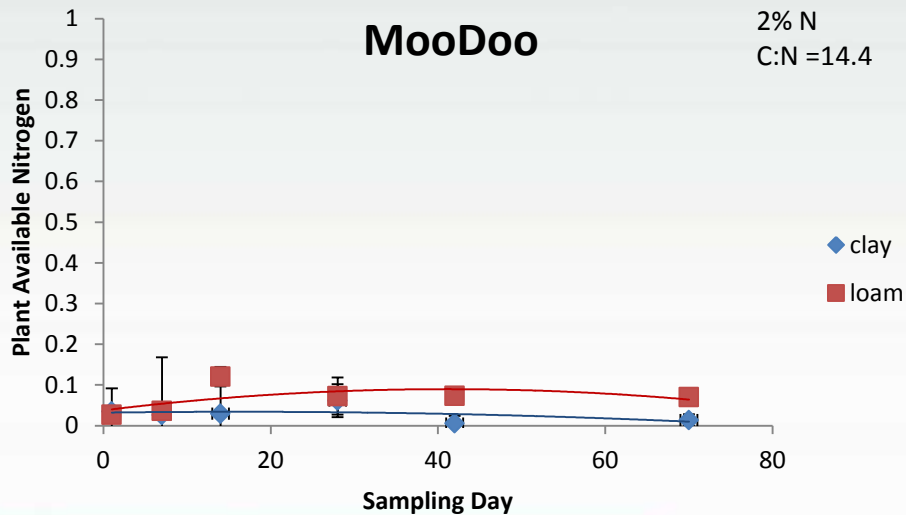
Kreher's

5.4% N
C:N = 5.8



MooDoo

2% N
C:N = 14.4



14 day
Giroux's = 0.5 lbs N in 100
Kreher's = 1.62 lbs N in 100

Amount of each amendment needed to contribute 100 lbs of Plant Available N during the 70 days after incorporation (average of two soils)

	Soy Meal	ProGro	Dried Blood	Poultry Litter	Chilean Nitrate
70 day PAN (%)	0.529	0.518	0.532	0.234	0.841
Amt needed (dm basis) †	2348	3807	1241	25470	744
Amt needed (wet basis) †	2647	4138	1340	45645	744
PAN†	100	100	100	100	100
Total N†	192	193	189	427	119
\$/lb N‡	\$2.87	\$7.80	\$6.95	††	\$3.50
\$/lb PA‡	\$5.75	\$15.0	\$13.0	††	\$4.46

