



Nitrogen Mineralization from Soil Organic Matter



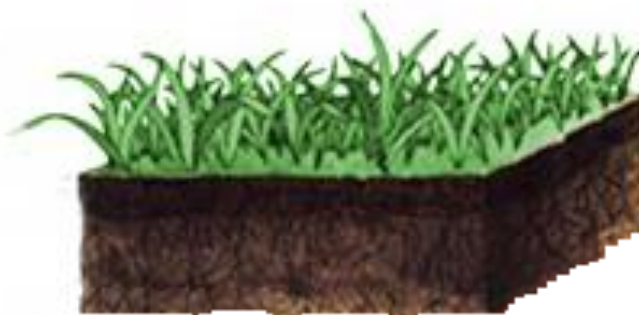
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Nitrogen in soil organic matter



Soil with organic matter content of 2%:

⇒ **2 tons N/acre in top foot**

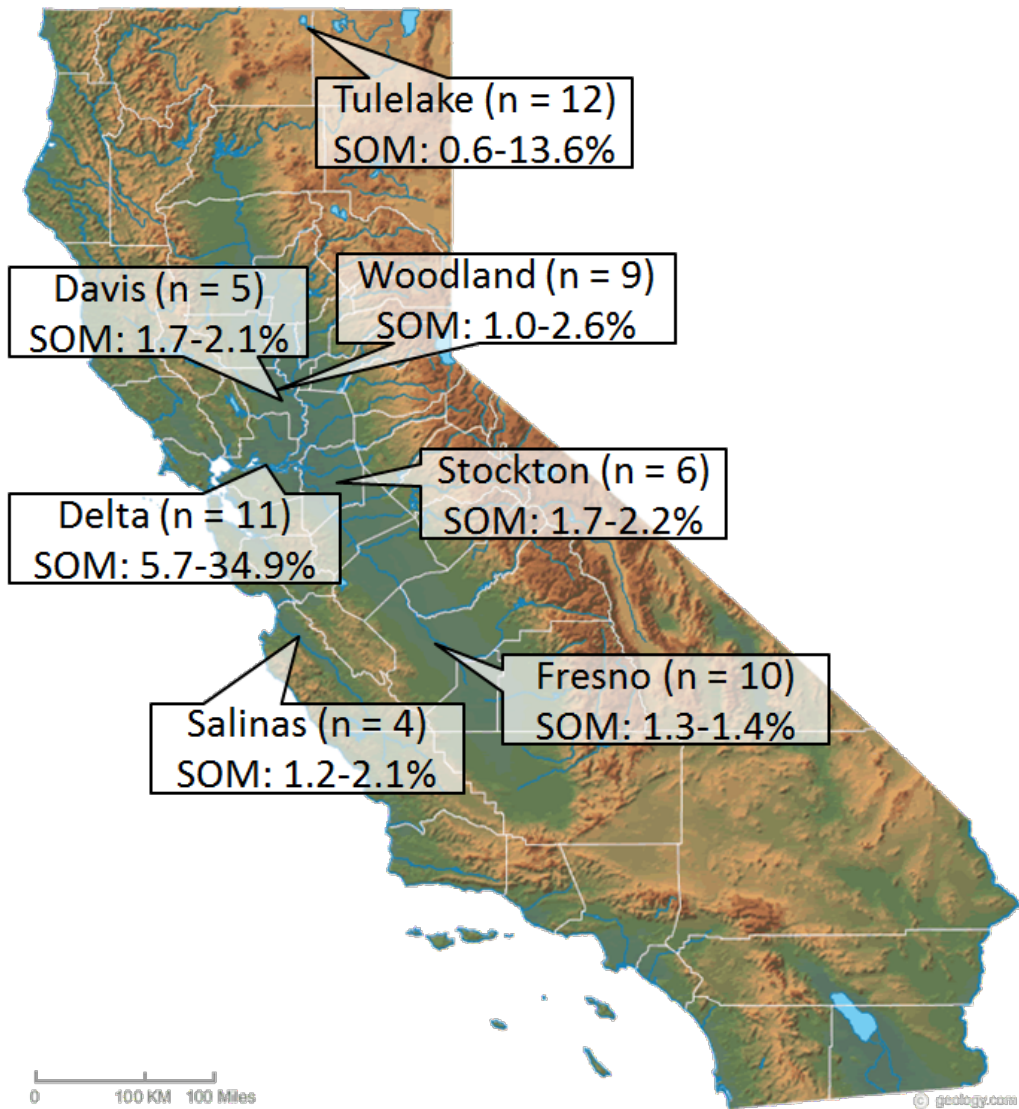


Our study

- Undisturbed soil cores were sampled in spring 2016 and 2017 from 57 fields
- Additional samples for soil analyses were taken right next to the cores
- Cores were kept at optimal moisture content and 41, 59, or 77 °F for 10 weeks
- Increases in ammonium and nitrate during these 10 weeks were determined



Study locations



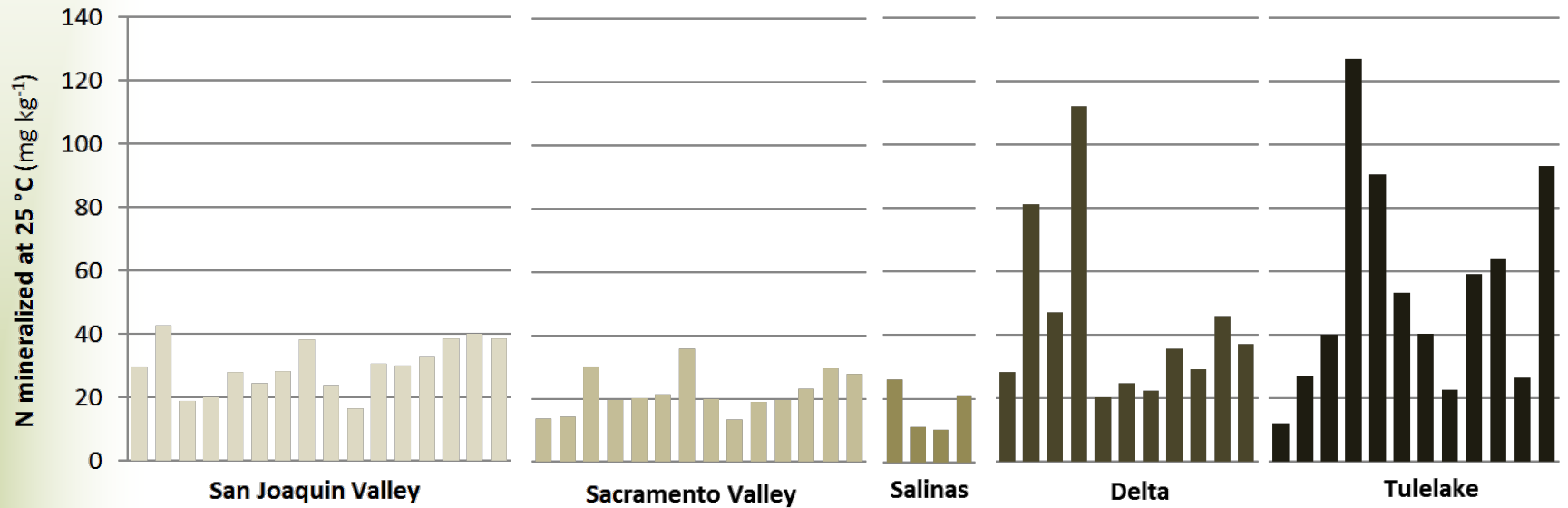


Soil characteristics

Region	Number of sites	SOM (%)	pH	EC (dS m ⁻¹)	Sand (%)	Clay (%)
Salinas Valley	4	1.6 (1.2 - 2.1)	7.5 (7.2 - 7.7)	0.2 (0.1 - 0.2)	47 (38 - 60)	16 (12 - 21)
Sacramento Valley	14	1.9 (1 - 2.6)	7.7 (7.2 - 8.1)	0.2 (0.1 - 0.3)	26 (5.5 - 65)	29 (11 - 59)
Northern San Joaquin Valley	6	2.0 (1.7 - 2.2)	7.6 (7.2 - 7.9)	0.2 (0.1 - 0.5)	16 (12 - 31)	38 (30 - 44)
Southern San Joaquin Valley	10	1.6 (1.3 - 2.0)	7.6 (7.2 - 8.1)	1.3 (0.4 - 2.5)	27 (8.7 - 35)	36 (20 - 49)
Delta	11	15.6 (5.7 - 34.2)	6.5 (5.9 - 7.3)	0.3 (0.1 - 0.6)	10 (0.9 - 19)	43 (32 - 61)
Tulelake	10	8.6 (5.4 - 13.5)	7.1 (6.2 - 7.6)	0.4 (0.1 - 1.0)	8 (2.3 - 16)	56 (49 - 69)



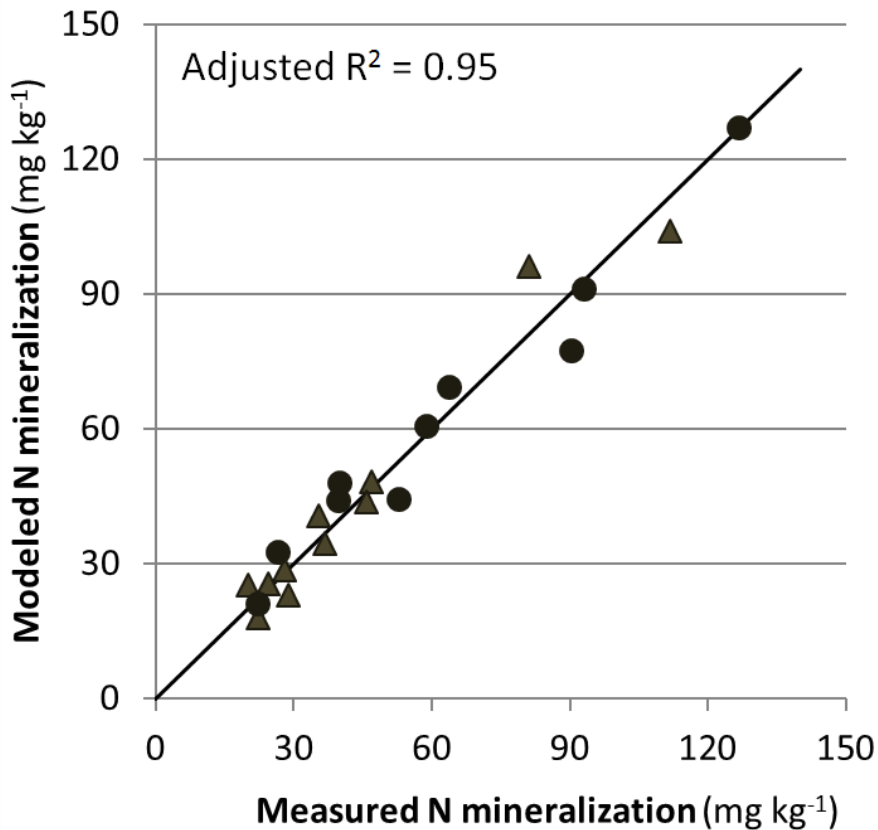
N mineralization rate in undisturbed soil cores



The cores were kept at 77 °F and a soil moisture content near field capacity for 10 weeks



Soil properties and N mineralization: Delta, Tulelake soils with a high SOM content

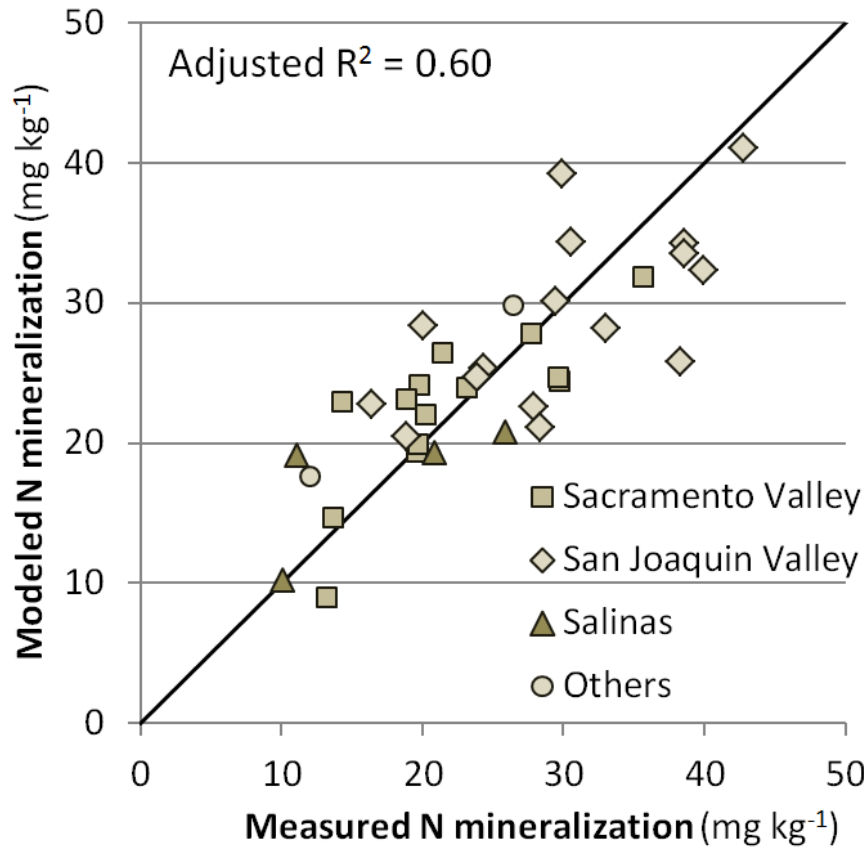


Relevant soil properties:

- Total carbon
- Total nitrogen
- Particulate organic matter
- Sand



Soil properties and N mineralization: Central Valley soils



Relevant soil properties:

- Total carbon
- FDA hydrolysis
- Silt



Sources of mineralizable N

- Plant residues
- Roots
- Root exudates
- Degradation of soil organic matter (SOM)
- Organic amendments



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Organic N inputs to Central Valley soils I

Crop	n	N input (lbs/acre per year)		
		Residue	Roots	Residue & roots
Wheat	6	48	18	66
Corn	5	68	29	97
Sorghum	1	50	15	66
Sunflower	2	44	2	46
Tomatoes	12	53	5	58
Alfalfa	3			100
Fallow	1	0	0	0
Weighted average				70

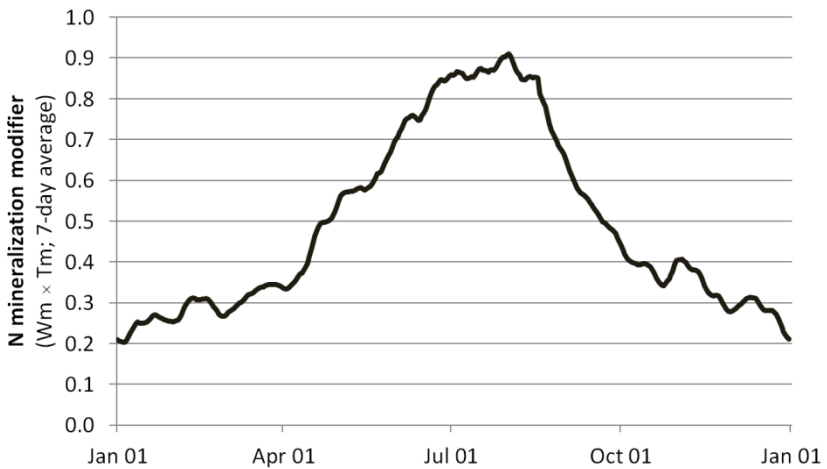
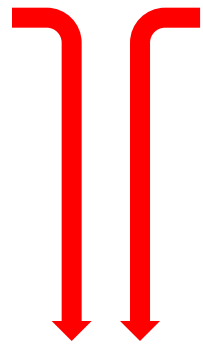
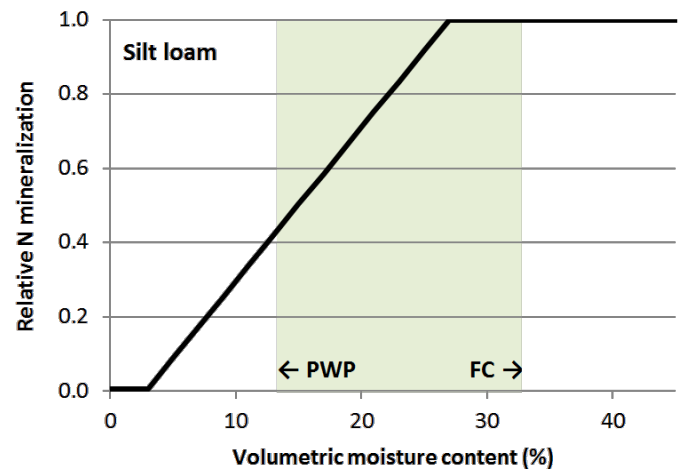
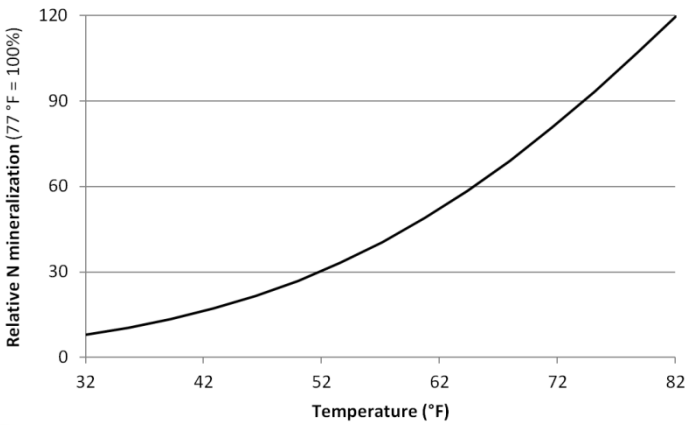


Organic N inputs to Central Valley soils II

N source	lbs N/acre per year
Average annual N input with roots and residues:	70
Rhizodeposition	23
Input with decreasing soil organic matter content:	17
Total organic N input:	70-110

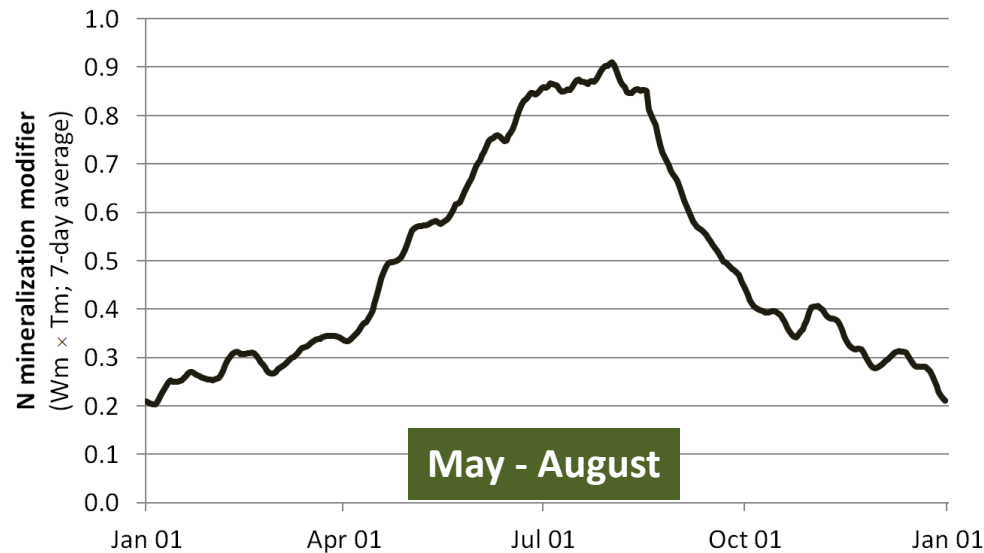


Temperature and moisture effects





N mineralization throughout the year



- In the Central Valley, the annual N mineralization likely ranges from 70-110 lbs/acre in fields with no history of legume cover crops and manure applications
- About half of the annual N is mineralized during a 4-month growing season



Conclusions

- Soil core incubations are valuable tool to
 - Compare different soils
 - Determine effect of soil properties
 - But overestimate N mineralization rates
- The organic N budget suggests that 70-110 lbs N/acre are mineralized per year in the top foot of the profile in Central Valley soils under annual crop rotations
- About half of the N is mineralized during a 4-month growing season
- Type and management of crop residues likely change the seasonal pattern of N mineralization



N mineralization throughout the year

Month	Central Coast		Sacramento Valley		Imperial Valley	
	SOM	1.5%	3.0%	1.5%	3.0%	0.75%
lb N acre ⁻¹ month ⁻¹ (top 12 ")						
January	3	6	2	5	2	3
February	3	6	2	5	2	3
March	4	7	3	6	2	5
April	5	9	4	8	3	6
May	6	11	6	11	4	8
June	6	12	7	14	5	10
July	7	14	9	17	6	12
August	7	15	8	17	6	13
September	7	13	7	14	5	10
October	6	11	5	11	4	8
November	4	8	3	7	3	5
December	3	6	2	5	2	4