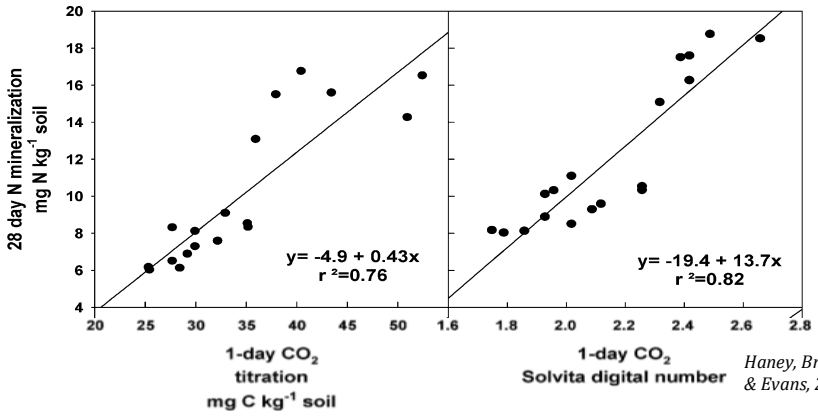
Can we predict seasonal N mineralization from soil respiration upon rewetting?

Russell Ranch Field Day- May 21, 2015

Background

Prediction of the soil's N-supplying ability would allow for more precise fertilizer recommendations to be made, resulting in many beneficial effects for concerned parties. Soil respiration (CO_2) upon rewetting has been shown to correlate with short-term (28-day) N mineralization in Texas soils amended with different rates of dairy manure. It is unclear if this observation is due to manure amendment or soil N-supplying ability. The mineralization of soil organic matter has been shown to account for >50% of plant N uptake in a given season (Kramer et al., 2002) in Russell Ranch soils.

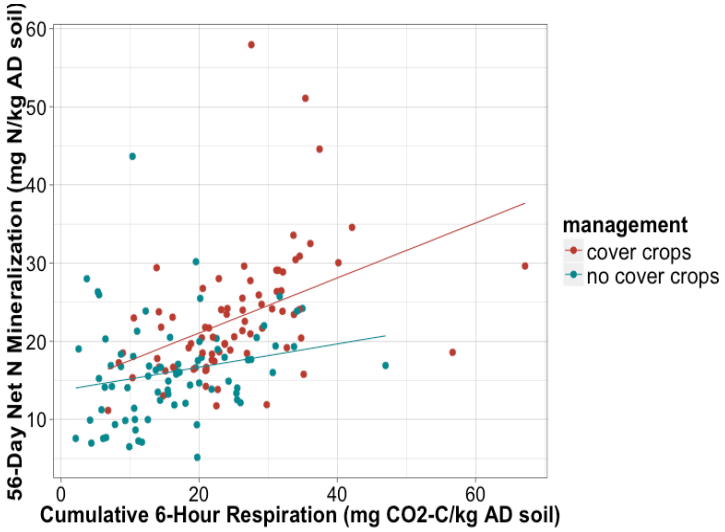


Haney, Brinton, & Evans, 2008

Examining this relationship in unamended California soils, we see several effects…

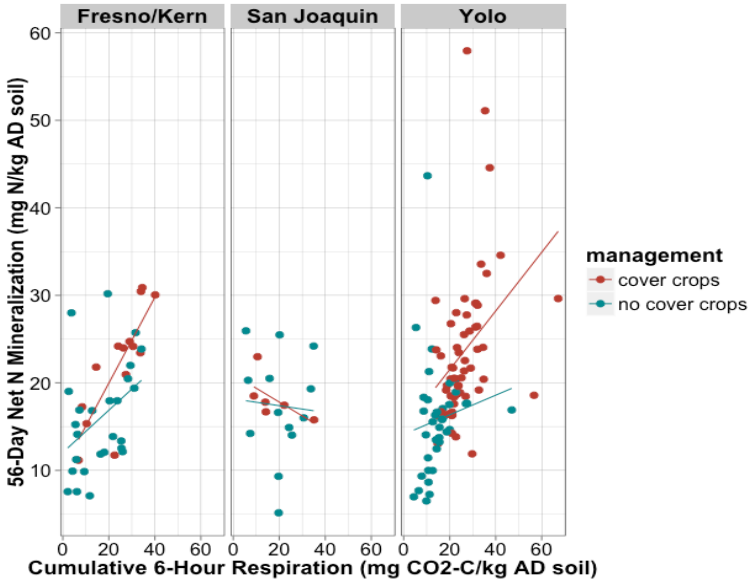
1. Management

You can see the slopes and how the nature of this relationship changes between managements that utilize cover crops and those that do not. The strength of these relationships differ, with an R^2= 0.0515 for management strategies without cover crops and R^2= 0.1906 for those fields with cover crops.



2. Location

The management effect differs by growing region. There are significant (p<0.05) effects of cover crops on the prediction of N mineralization in Yolo county, no difference in San Joaquin County, and moderately different effects (p<0.10) in Fresno/Kern Counties.



Integrating Chemical Indices for Better Prediction

Labile carbon (DOC) and total soil N content have strong effects that also help in the prediction of 56-day N mineralization.

$NMIN_{56}$= -4.946 + 0.179*CO_2.6 + 0.183*DOC + 105.564*Total N

R^2_{adj}=0.5174

Response Variable: $NMIN_{56}$

	df	F-Statistic	*p*-value
6-Hour CO_2	1	71.20	***
DOC	1	10.49	0.0015**
Total N	1	68.03	***
Management	1	6.85	0.0098**
Location	3	4.81	0.0032**

Significance: * p≤0.05, **: p≤0.01; ***: p≤0.0001

Conclusions

Respiration is not an acceptable as a standalone predictor of net N mineralization. The relationship between 6-hour cumulative respiration and 56-day N mineralization is significantly affected by management strategies utilizing cover crops, but this relationship varies by growing region. Incorporating measurements of labile C and total N supply of a soil has the potential to provide better estimations of N mineralization.

Contact: Jordon Wade, jordonwade@gmail.com

Special thanks to CDFA Fertilizer Research & Education Program (FREP) for funding