**Title: Reducing nitrate leaching to the groundwater by accounting for the soils' capacity to supply N through mineralization**

**Rationale:** California is a highly productive agricultural region. Its nutrient intensive production, however, has led to increased nitrate concentrations in the groundwater with a large proportion of this nitrate likely originating from nitrogen (N) fertilizer use in agriculture. California growers are now facing increasing pressure to improve N use efficiency in crop production to reduce nitrate leaching. At the same time, growers need to maintain high yield levels to remain competitive. This is only possible when non-fertilizer N inputs can be quantified accurately, so that fertilizer application rates can be adjusted with confidence. Besides residual nitrate and nitrate in irrigation water, N mineralized from organic material during the growing season can be a major source of crop available non-fertilizer N. The proposed project builds on results from an ongoing two-year project funded by the California Institute for Water Resources where we determine N mineralization in soil from fields with no history of cover crops and manure applications. In spring 2016, we took undisturbed soil cores from 30 fields under annual crops located in the northern half of California. The cores were incubated for 10 weeks. A model based on total soil carbon (C), total soil N, pH and particulate organic C was best in predicting N mineralization based on soil properties (Figure 1). While the model predicted N mineralization very well in soils with a higher soil organic matter (SOM) content, it was less precise in low organic matter soils, which are common in the Central and Salinas Valley.

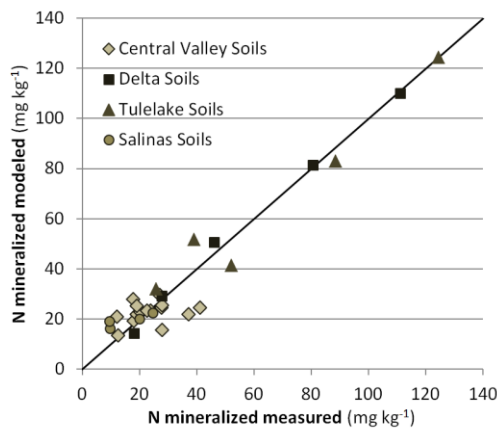


**Figure 1:** Comparison between measured and modeled N mineralization in fields with no recent history of cover crops and manure applications.

**Hypothesis:** We hypothesize that the N mineralization estimate can be considerably improved for soils with a low SOM content by including quality, quantity and management of residues from the previous crop.

**The objectives of this project are (i) to determine the contribution of crop residues and management to N mineralization is soils under annual crops in California and (ii) to develop a user friendly decision support tool to estimate the contribution of N mineralization to plant available N, thus help growers reduce the risk of nitrate leaching to the groundwater.**

**Research and outreach approach:** The objectives will be addressed by sampling crop residue and soil in fall 2018 from the top foot of the profile from 25-30 fields in different regions of California. The chemical composition of the residues shall be determined. Incubations with residue additions shall be carried out with the soil sampled in the same field as well as an air-dried soil sampled at the beginning of the project from a field at UC Davis. Including the UC Davis soil allows comparison of N mineralization rates from different residues across years. Net N mineralization will be determined after 2, 4, 8, 14 and 20 weeks. In spring 2019, undisturbed soil cores from the same fields will be sampled pre-plant and incubated for 10 weeks. These tasks will be repeated at the same locations in years 2 and 3 of the project. This will allow investigating the relationship between residue characteristics and N mineralization by stepwise regression analysis. In addition, data about crop management (obtained from the grower), soil and residue properties (measured in our lab), as well as weather data (obtained from the nearest CIMIS station) will be used to calibrate the DSSAT soil-crop model for each site. Model predictions will be compared with N mineralized in undisturbed soil cores. Following successful calibration, different scenarios, e.g. the effect of residue C to N ratio or effects of winter conditions on N mineralization during the cropping season, will be simulated.

**Impact, Outcomes:** Results of this project will be incorporated into a decision support tool for use by growers and crop advisers. The tool shall help reduce the risk of nitrate leaching to the groundwater by taking into account crop available N supplied by mineralization. This project will also allow investigating the effects of crop residues on residual soil nitrate measured in spring. In addition, SOM and other properties commonly used as indicators of soil health will be determined, thus providing baseline values from a wide range of agricultural soils from California for projects focusing on soil health.