# Agriculture and Climate Change

## Examining the role of agricultural management practices in the emission of nitrous oxide, a greenhouse gas.

WITH THE PASSAGE of the California Global Warming Solutions Act of 2006 (AB32), California has begun an urgent effort to reduce greenhouse gas (GHG) emissions to 1990 levels by 2020. Of the three major greenhouse gases—$CO_2$, $N_2O$, and $CH_4$—nitrous oxide, or $N_2O$, has 296 times the radiative force of $CO_2$, greatly contributing to the destruction of the ozone and increasing global warming. Agricultural cultivation of soils is the main source of anthropogenic nitrous oxide emissions worldwide. However, very little data exists on annual nitrous oxide changes as they are erratic and highly dependent on management practices. In order to create an accurate greenhouse gas budget for California, we must first quantify greenhouse gas emissions resulting from different cropping systems and management practices.

The goal of our study was to quantify seasonal and annual nitrous oxide emissions in a California almond orchard and vineyard in order to contribute to the development of an accurate greenhouse gas budget for California. Furthermore, we wanted to determine how conventional agricultural management practices influence these emissions in order to develop best management practices to reduce $N_2O$ emissions.

▲ Emissions are measured following fertilizer application in an almond orchard located in Arbuckle, CA. Between 1990 and 2004, 94% of the $N_2O$ emissions in the United States were produced from agricultural soils. One of the major causes of these increased emissions is the amplified use of synthetic nitrogen fertilizers in many crops, which leads to vast annual $N_2O$ emissions worldwide. However, it is unclear how specific management practices in most perennial cropping systems affect $N_2O$ emissions.

▲ $N_2O$ emissions are measured using a closed-flux chamber method. The chambers are made of PVC pipe, which is inserted into the ground to a depth of 5 cm.

The chambers are placed under the vineyard's surface drip irrigation system in order to measure nitrous oxide emissions from irrigation and fertilization events. The drip system is used to provide small doses of water to the vine roots during the growing season while reducing water loss to evaporation. ▶

▲ The gas samples are removed from the chambers using an airtight syringe. These samples are then injected into pre-evacuated vials. By measuring the concentration of $N_2O$ in the vials over three equal time points using a gas chromatograph, the concentration of $N_2O$ from the soil can be calculated.

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