

## HOW DO WE MEASURE GREENHOUSE GAS FLUX FROM FARMS IN NOVA SCOTIA

A natural greenhouse effect warms the earth to a point where it can sustain life. Certain gases in the atmosphere, such as carbon dioxide (CO<sub>2</sub>), prevent the release of heat back to space by trapping this energy at the earth's surface. However, high concentrations of these gases in the atmosphere cause too much energy (heat) to be trapped, leading to increased temperatures, global warming and climate change.

Climate change is a concern for everyone. Agricultural producers are particularly affected, since temperature increases and more frequent severe weather events resulting from climate change make management decisions regarding seeding dates, crop selection, pest and disease management, and irrigation strategies more of a challenge.

The three most important agriculturally produced greenhouse gases (GHG's) are nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>) and CO<sub>2</sub>. In Canada, agricultural activities account for approximately 10% of all GHG's emitted, with individual emissions divided as 6.1% as N<sub>2</sub>O, 3.6% as CH<sub>4</sub> and <0.1% as CO<sub>2</sub>.

### HOW DO WE MEASURE GHG'S ON A FARM?

The closed chamber technique is a reliable, effective, economical approach for measuring GHG's. The rate of gas accumulation in the headspace of a chamber is measured, which can then be related to the emission of GHG's from the soil surface.



A typical GHG flux monitoring kit.

### MEASUREMENT TECHNIQUE

Collars constructed from PVC pipe (10 cm in height and 20 cm in diameter) are inserted into the ground, leaving 2.5 cm above the soil surface. These collars can be left in place for the duration of study.

A measurement is taken by placing an insulated vented chamber on top of a collar, trapping emitted gases. The chamber has a self-sealing sampling port on its upper surface, allowing for extraction of exact-volume samples of gas from the headspace using a syringe. The withdrawn sample is injected into an evacuated exetainer (i.e. vial). Samples are typically extracted at 0, 10, 20 and 30 minutes.



Extracting a GHG sample; injection into an vial.

Following field sampling, the exetainers are transported to a laboratory for analysis. Using gas chromatography technology, the concentrations of the GHG's are determined. Fluxes are based on the rate of increase in GHG concentration in the headspace over the 30 minute measuring period.

Environmental parameters, including soil moisture, relative humidity, and soil and air temperature, are measured each time GHG sampling is conducted. Soil and bulk density samples characterize the research location and provide nutrient content and soil physical characteristics.

### SUMMARY

Sampling by this method is typically conducted for agricultural crops before and after seeding, fertilization and harvesting, and periodically throughout the season. Overall this technique is simple, inexpensive and applicable to most field and research activities.