Contribution of pulse crop residues and soil to N_2O and CO_2 emissions in a subsequent wheat crop: A $^{13}C/^{15}N$ study

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Introduction

Above-ground residue
Below-ground residue
Incorporated in the field

1. How much do above-ground (AG) and below-ground (BG) residues contribute to total N_2O and CO_2 emissions?
2. How do residue-, soil- and fertilizer-derived N_2O and CO_2 emissions compare?

Field study

- May 2014 – Oct. 2015
- Goodale Research Farm

  University of Saskatchewan, Canada
- Crop sequence: pulse followed by spring wheat

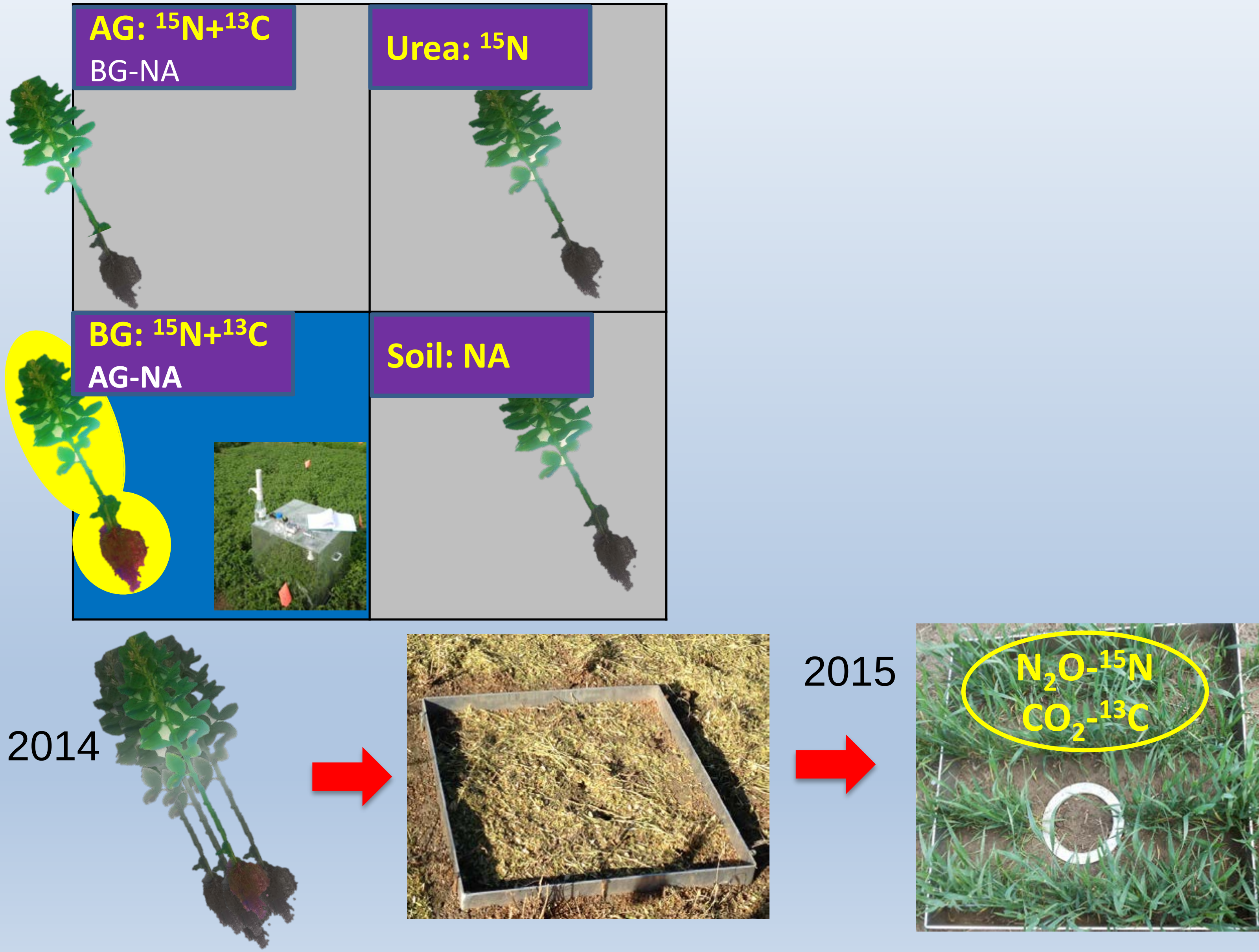
2014: Phase 1 Treatments

- Pea
- Lentil
- Chickpea
- Fababean
- Wheat (0 kg N ha^{-1})
- Wheat (45 kg N ha^{-1})

2015: Phase 2

- Wheat (45 to 60 kg N ha^{-1})

Within plot ^{15}N-^{13}C labeling approach



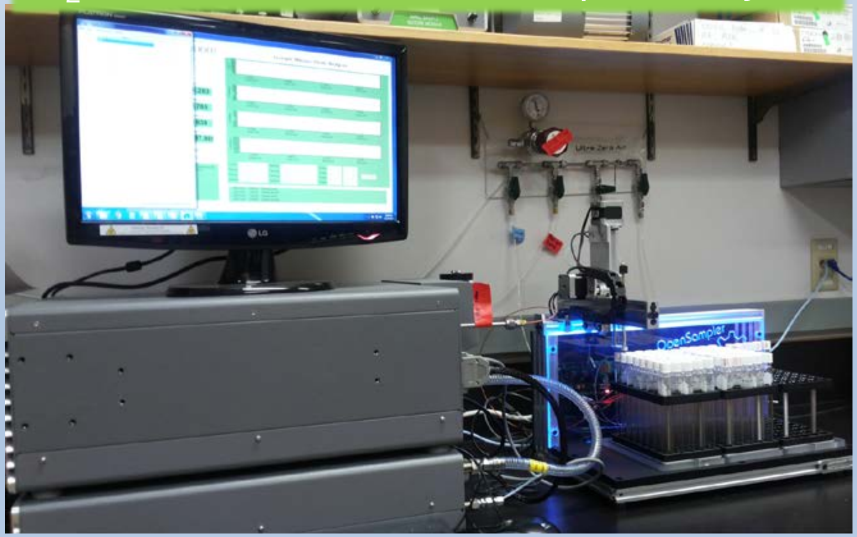
N_2O-^{15}N and CO_2-^{13}C measurement

Picarro isotopic N_2O and CO_2/CH_4 analyzers

Cavity Ring-Down Spectroscopy (CRDS)

G5131-*i*

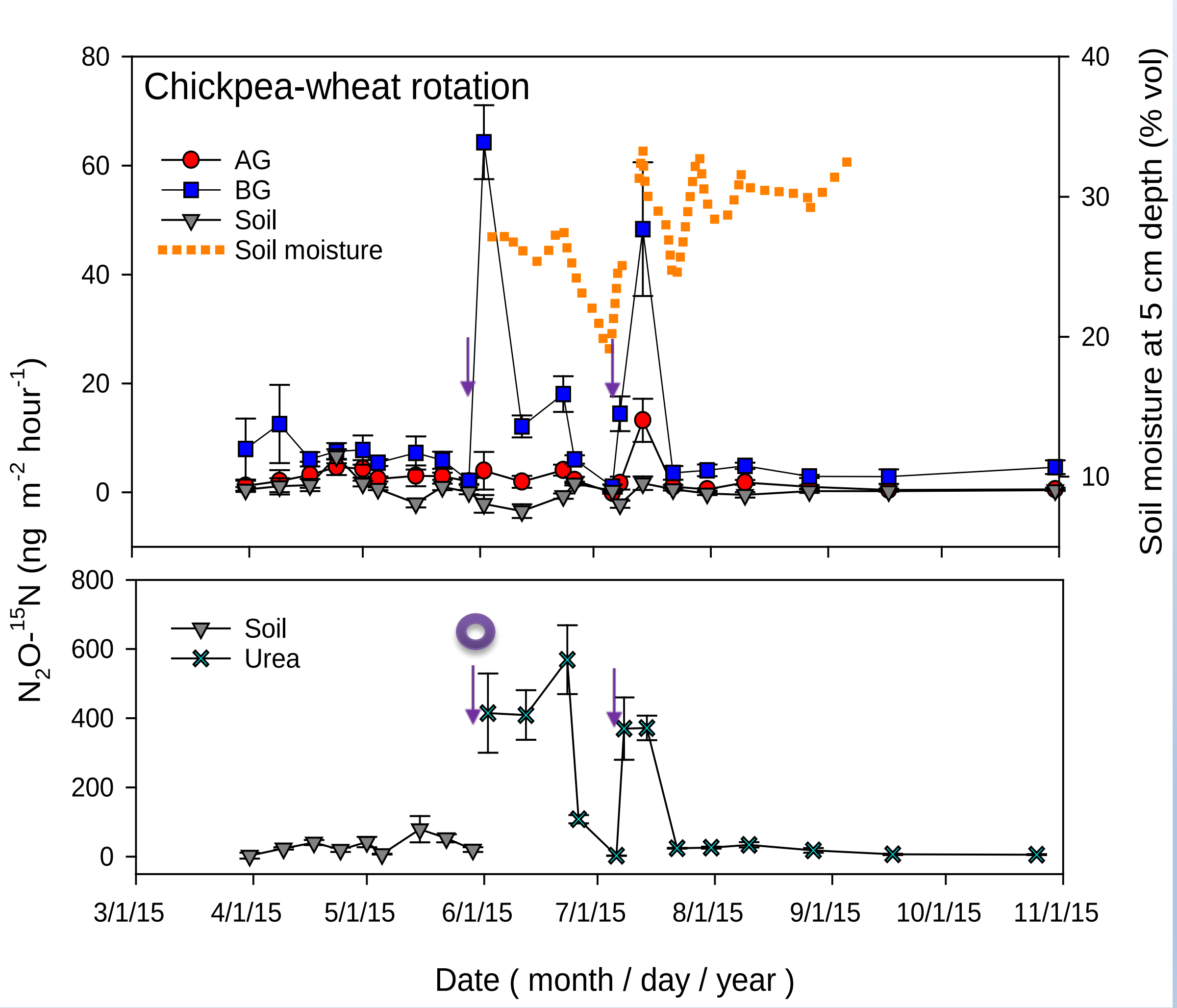
N_2O Concentration and Isotopes Analyzer



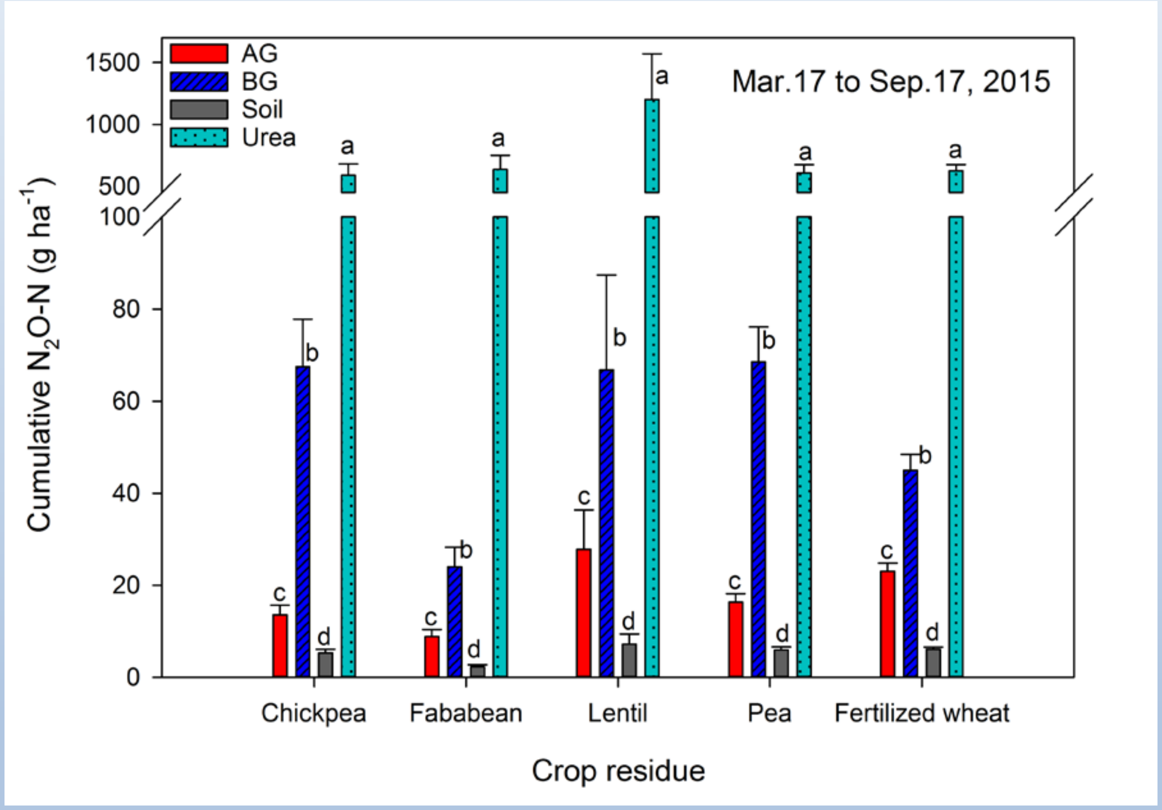
G2201-*i* analyzer

$\delta^{13}C$ for CH_4 and CO_2

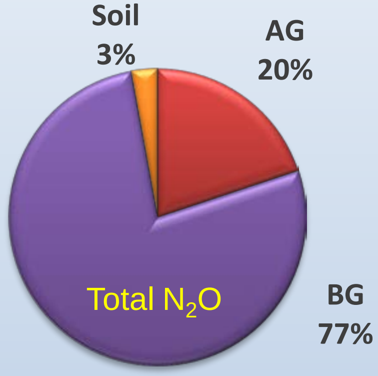
Mean N_2O-^{15}N emissions, and soil volumetric moisture during the 2015 growing season



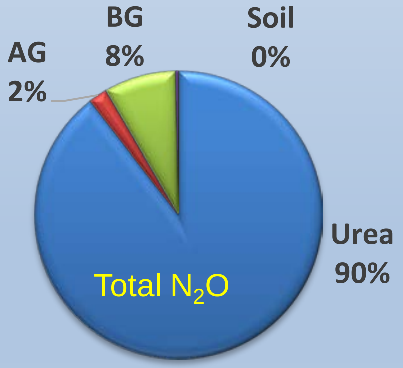
Cumulative N_2O-N emissions



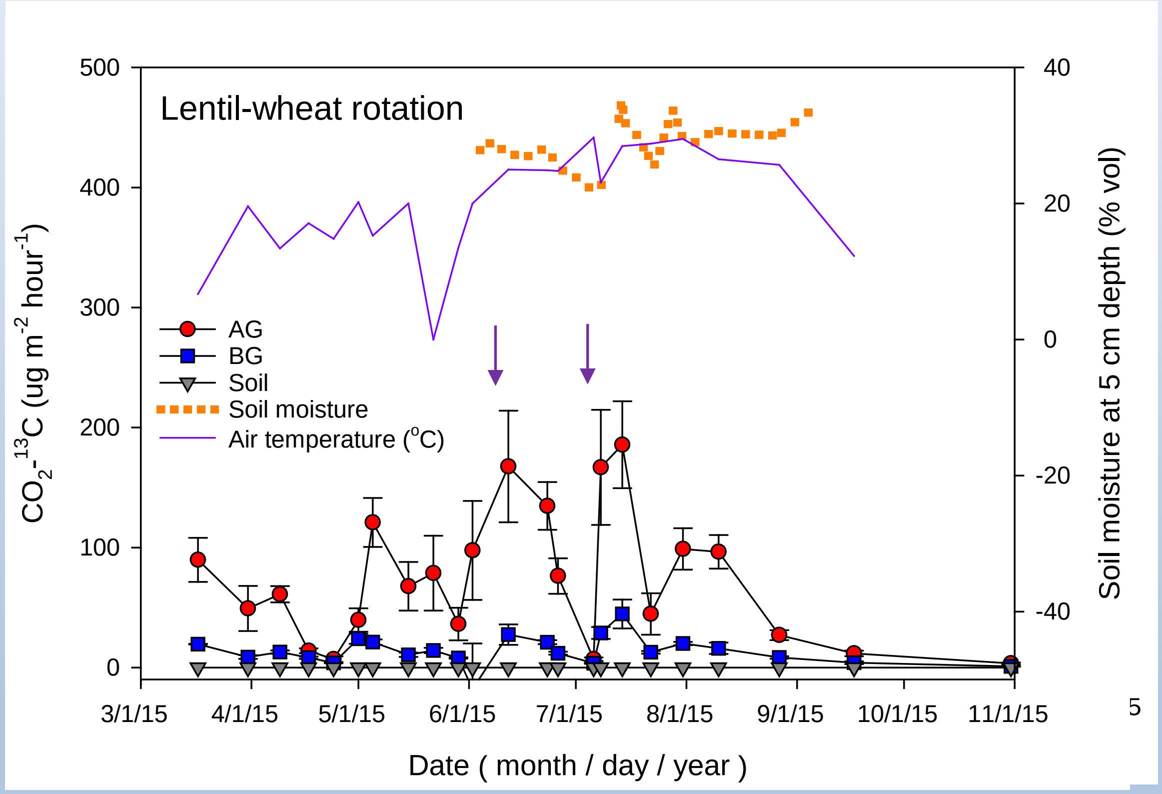
Without N fertilizer



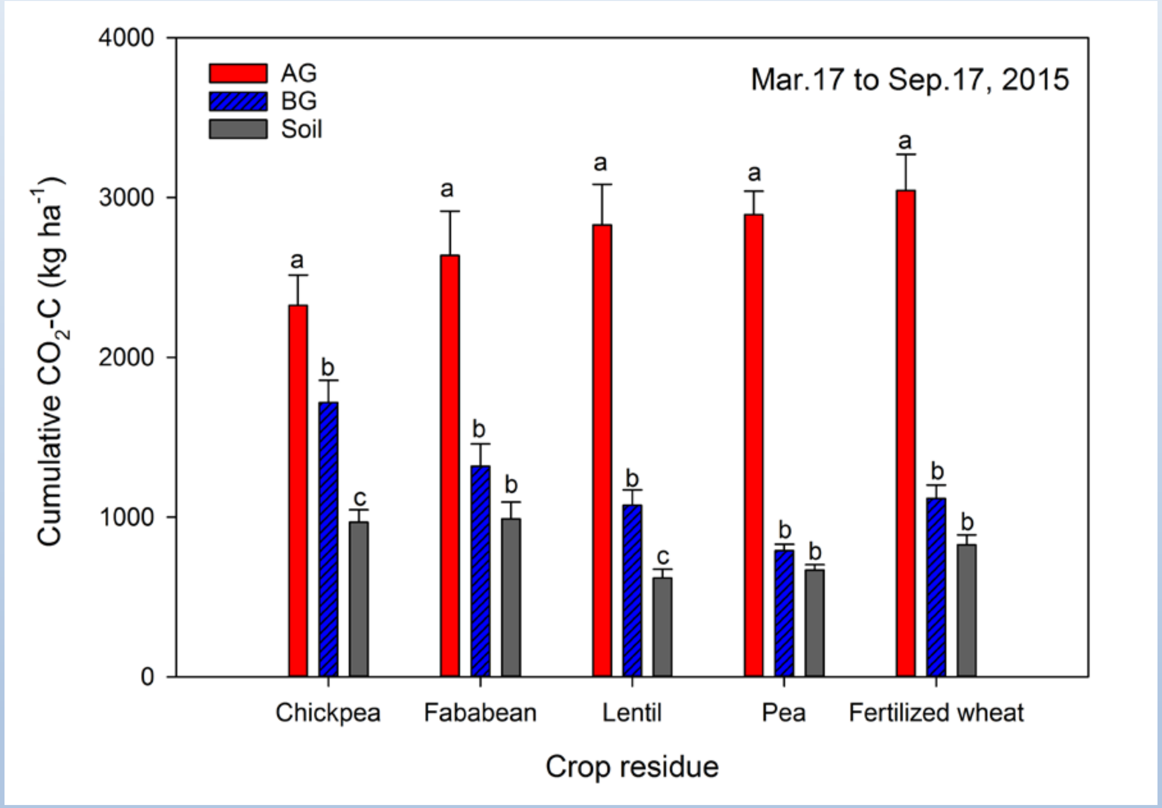
With N fertilizer

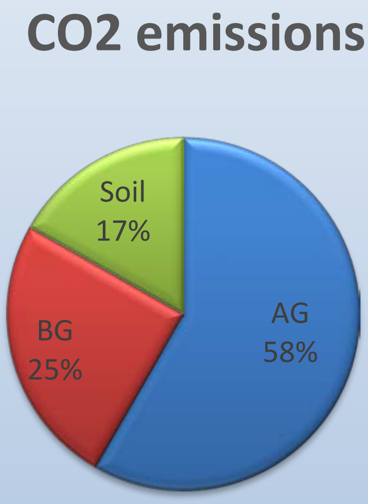


CO_2-^{13}C dynamics



Cumulative CO_2-C emissions





Conclusions

Fertilizer was the dominant source of N_2O, contributing 81-91% N_2O

Soil contributed less than 1% N_2O

Crop residue contributed 7-17% N_2O
(AG: 1-3%; BG: 6-14%)

N contribution of BG residues > N contribution of AG residues

Conclusions

AG residue contributes 46-66% CO_2

BG residue contributes 18-34% CO_2

Soil itself contributes 13-20% CO_2

C contribution of AG residue > C contribution of BG residue

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SASKATCHEWAN pulse Growers

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