7th International Nitrogen Conference (INI 2016)
'SOLUTIONS TO IMPROVE NITROGEN USE EFFICIENCY FOR THE WORLD'

Nitrous oxide emission from N fertilizer and vinasse in sugarcane

Heitor Cantarella, Lourenço, K.S., Soares, J.R., Carmo, J.B., Vitti, A.C., Rossetto, R., Montezano, Z.F., Kuramae, E.[4]

Agronomic Institute of Campinas (IAC), Brazil, Federal University of São Carlos, Brazil; APTA Regional, Brazil; NIOO, The Netherland

GHG & Ethanol sustainability

- Sugarcane in Brazil: 9 Mha, ~1/2 for ethanol (40% of liquid fuel)
- N_2O from N fertilizers accounts for up to 40% of the GHG emission from sugarcane ethanol (Lisboa et al., 2011
- Vinasse enhances up to 3 times N_2O emissions
  - Vinasse: 10-13 L/L ethanol

- OBJECTIVE: Understand interaction of N fertilizer and vinasse for N_2O emissions; find alternative to reduce GHG.
- STRATEGY: Use concentrated vinasse (less volume);
  Separate application in time - Vinasse 30 days before or after N fertilization

N fertilizers and by- products of sugarcane and ethanol affect N_2O emissions

Material & Methods

- 3 field experiments with ratoon sugarcane in Brazil
  - Red Latosol: rainy season: 2013/14, dry season: 2014/2015 and rainy season: 2014/2015; Straw: 10-14 t/ha dry matter
- N rate: 100 kg ha^{-1} (ammonium nitrate);
- Standard vinasse (V): 100 m^3 ha^{-1}; Concentrated Vin. (CV): 17 m^3 ha^{-1};
- Treatments: combination of V, CV, and N fertilizer
  - Postpone or delay vinasses with regard to fertilizer
- Intense measurements of N_2O fluxes using static chambers
- Sampling: 3 times per week (first 105 days); biweekly after that

Emission factors of V & N

Treatments	n	N rate (N, V, + CV) kg/ha	Emission Factor (%)	
			Range	Mean
N	3	100	0.07 – 0.51	**0.23**
CV	5	40	0.18 – 0.56	**0.34**
V	6	73	0.00 – 1.84	**0.66**
V+N	3	172	0.18 – 0.71	**0.43**
CV+N	3	149	0.63 – 1.39	**0.94**
V+N separated in time	3	154	0.09 - 0.55	**0.29**
CV+N separated in time	2	133	0.26 – 0.56	**0.41**

- **EF usually low; variable (time of the year & climate)**
- **Much needed data on EF for sugarcane N and Vinasses (field, different seasons)**
- **On average of 3 experiments: CV + N increase N_2O emission factor (0.94% of applied N) as compared to fertilizer N (0.23%)**
- **Concentrated vinasse: enhanced N_2O emission more than regular vinasse**
- **Strategy of separating in time: worked only for CV. Not the management choice of the industry**

IAC

Heitor Cantarella

cantarella@iac.sp.gov.br