GREENHOUSE GAS EMISSIONS FROM SUGARCANE PRODUCTION IN SÃO PAULO STATE: LESSONS LEARNED FROM THE FIELD

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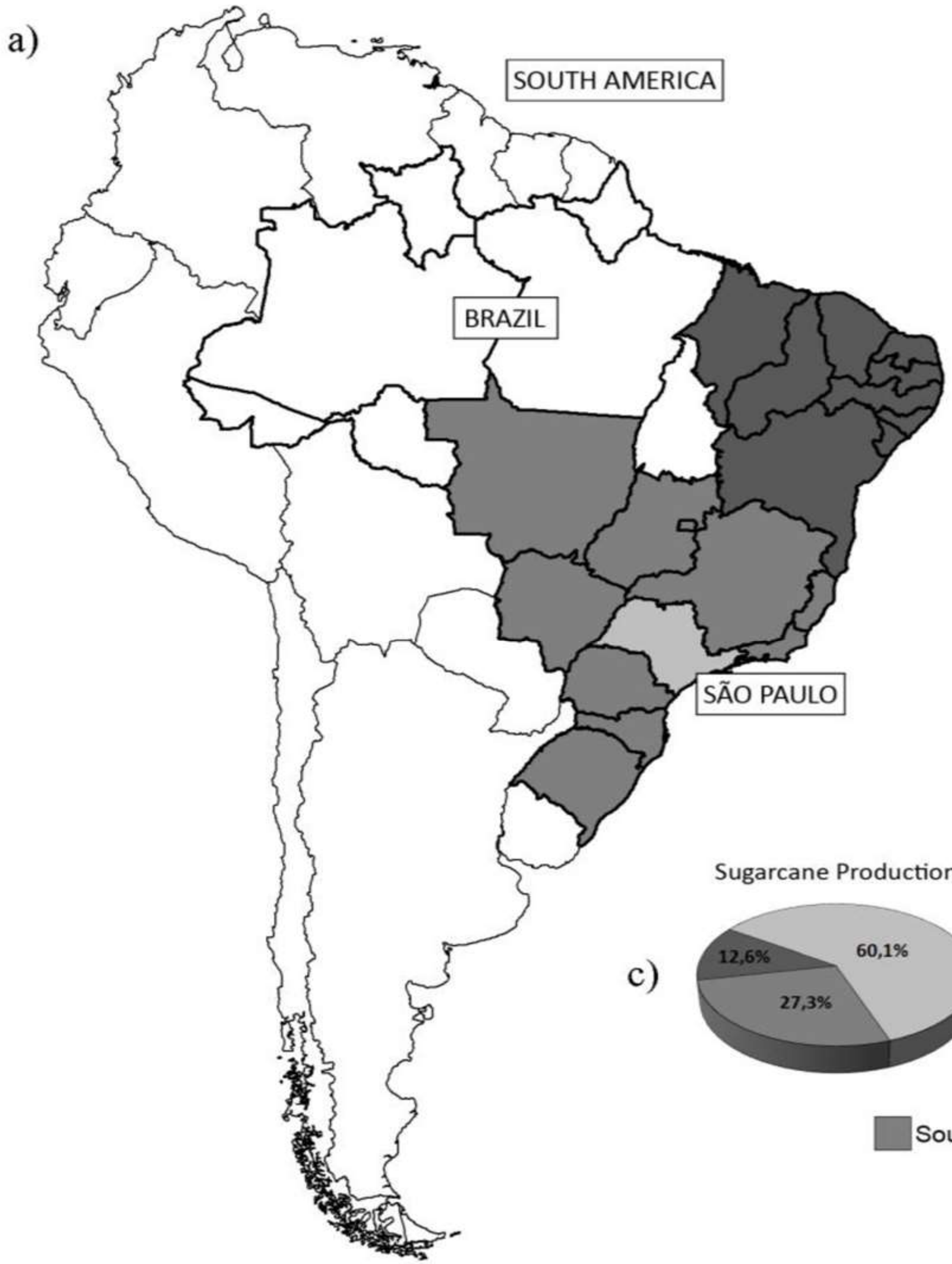
FAPESP WEEK, FRANCE, Nov 2019

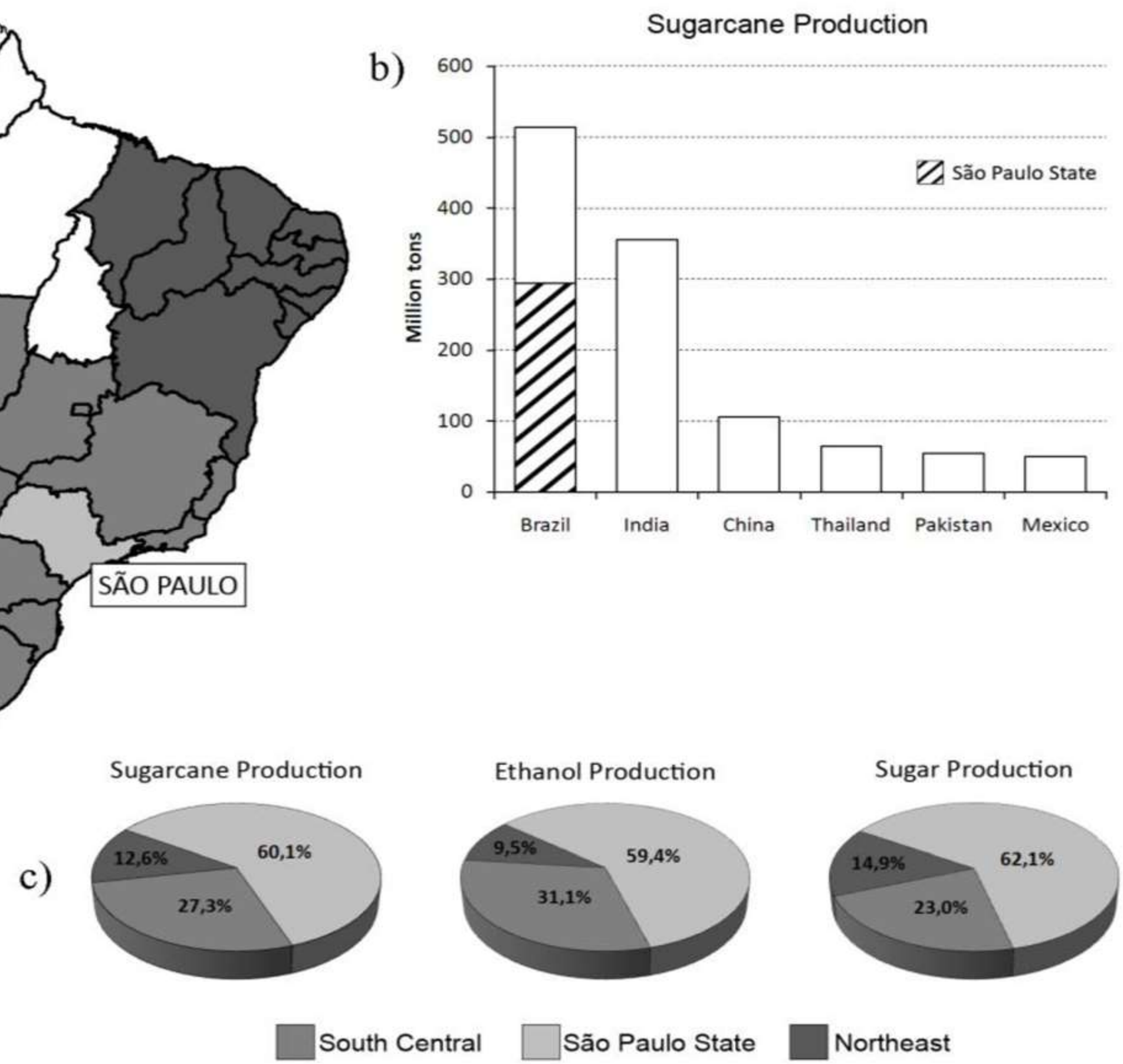
ORGANIZATION OF THE PRESENTATION

PART 1 – GHG EMISSIONS AFTER FERTILIZER AND BY-PRODUCT APPLICATION

PART 2 – LAND USE CHANGES AND SUGARCANE EXPANSION TO DEGRADED PASTURES

PART 3 – SUGARCANE EXPANSION AND INTEGRATION OF RESEARCH AREAS





Rudolf et al, 2010, Remote sensing

Atmos. Chem. Phys., 8, 389–395, 2008
www.atmos-chem-phys.net/8/389/2008/

Atmospheric Chemistry and Physics

N_2O release from agro-biofuel production negates global warming reduction by replacing fossil fuels

P. J. Crutzen[1,2,3], A. R. Mosier[4], K. A. Smith[5], and W. Winiwarter[3,6]

Calculated emissions factor
3-5%

IPCC
1%

BY-PRODUCT APPLICATIONS

N_2O CO_2 CH_4

Filter cake ?

Vinasse ?

Straw ?



T1 0 t ha^{-1} straw

T2 7 t ha^{-1} straw

T3 14 t ha^{-1} straw

T4 21 t ha^{-1} straw

Fertilizer application

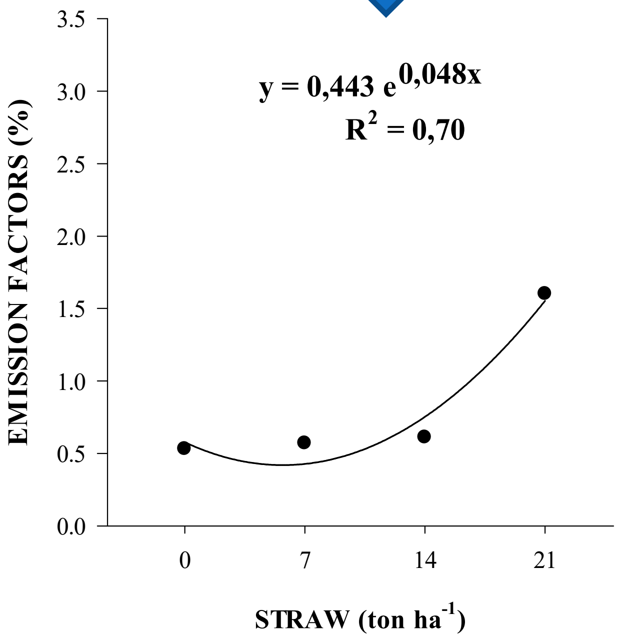
Vinasse application

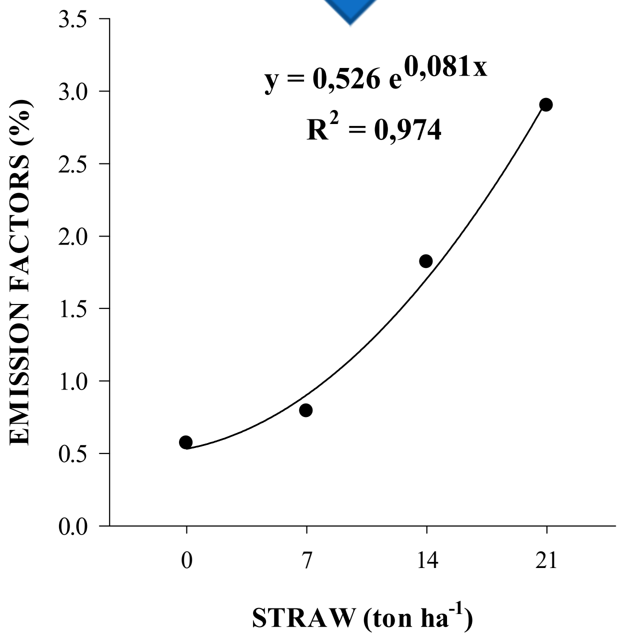
Gases Sample

VINASSE AND STRAW EFFECT ON EMISSION FACTORS

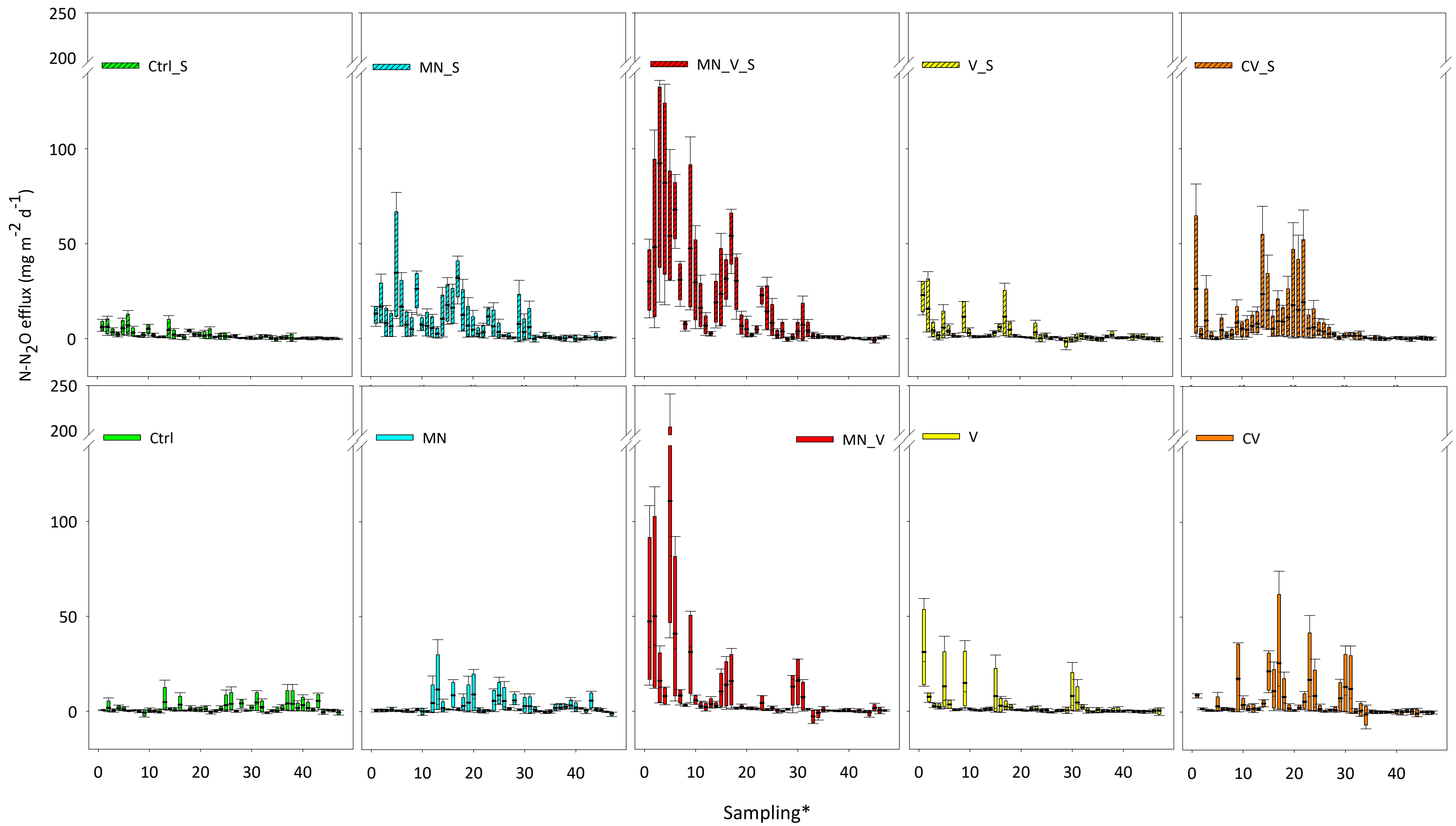
FERTILIZER

FERTILIZER+VINASSE



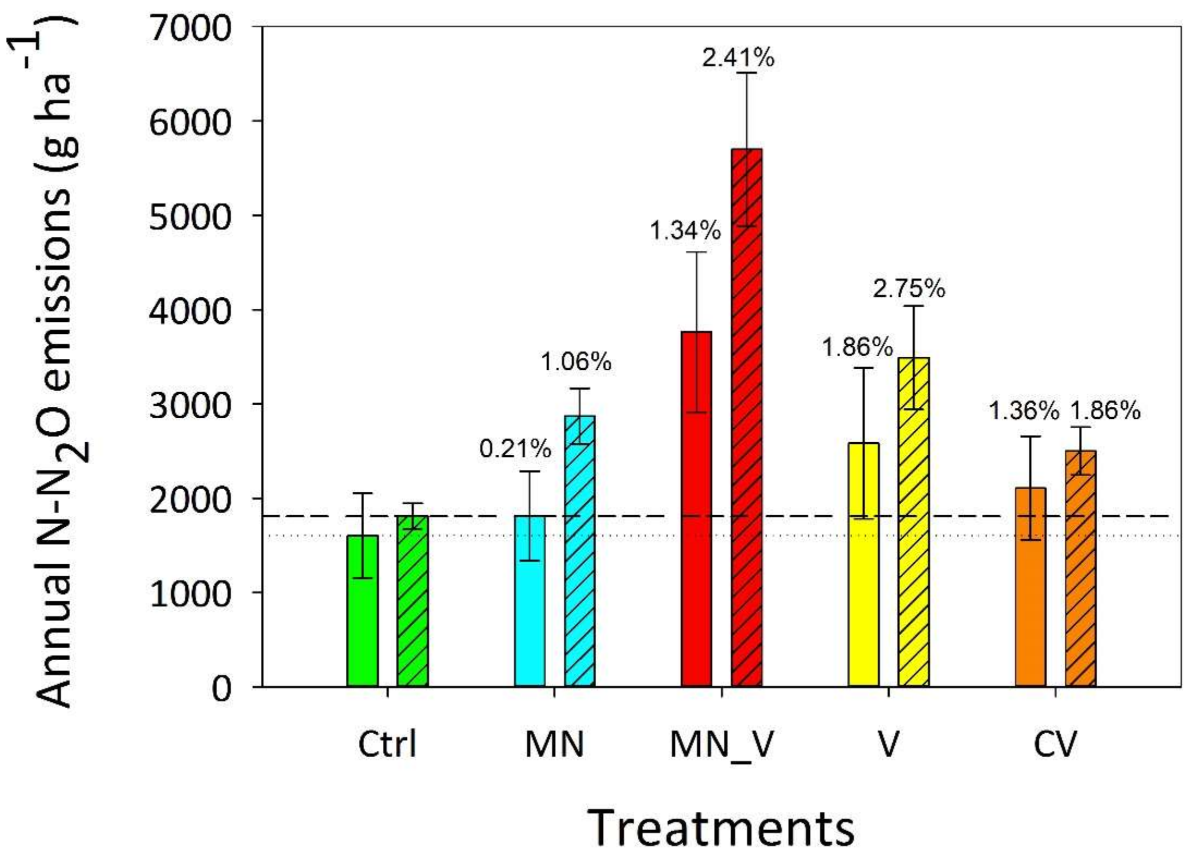


VINASSE AND STRAW EFFECT ON EMISSIONS



Pitombo et al., 2016 –GCB-B

Regular vinasse and concentrated vinasse applied jointly with nitrogen fertilizer

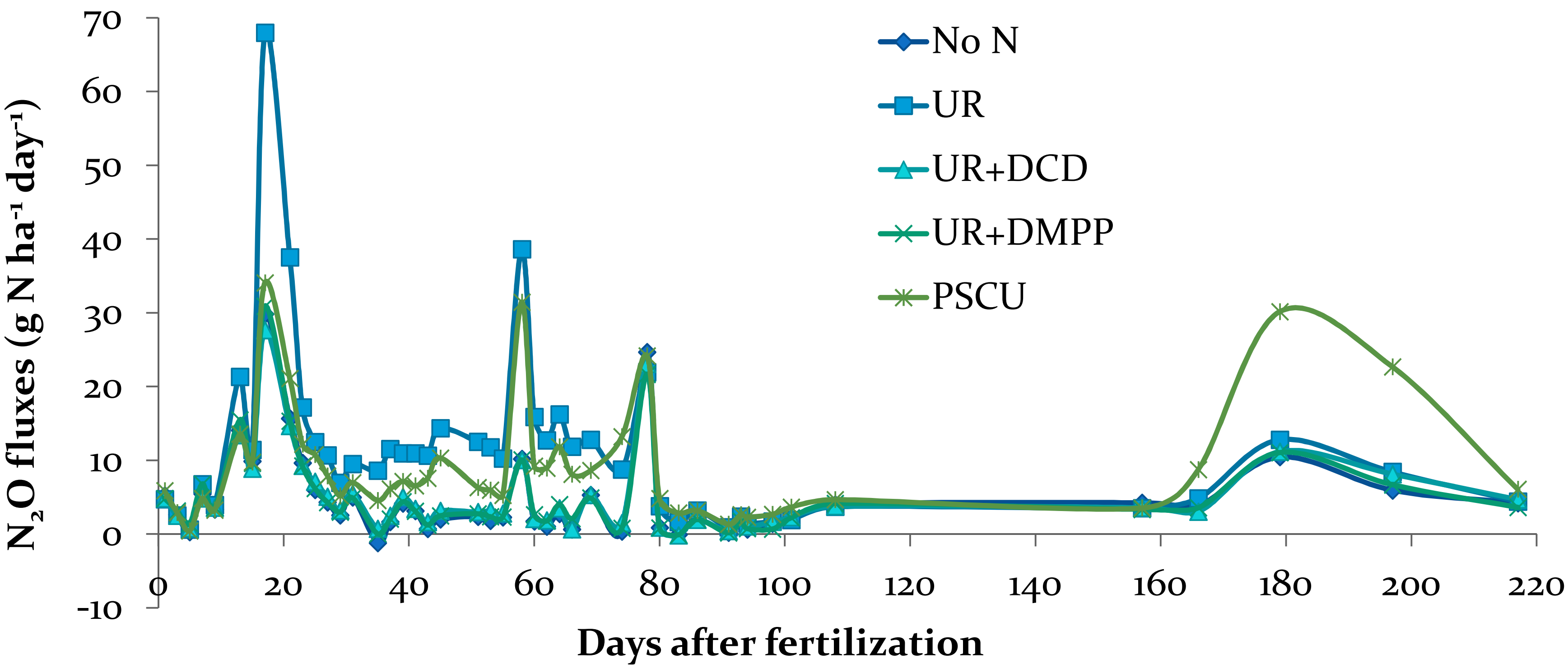


Pitombo et al., 2016 –GCB-B

Journal of Environmental Quality
SPECIAL SECTION
IMPROVING NITROGEN USE EFFICIENCY IN CROP AND LIVESTOCK PRODUCTION SYSTEMS

Enhanced-Efficiency Fertilizers in Nitrous Oxide Emissions from Urea Applied to Sugarcane

Johnny R. Soares, Heitor Cantarella,* Vitor P. Vargas, Janaina B. Carmo, Acácio A. Martins, Rafael M. Sousa, and Cristiano A. Andrade



AVOIDING EMISSIONS - ALTERNATIVES TO using only FERTILIZERS

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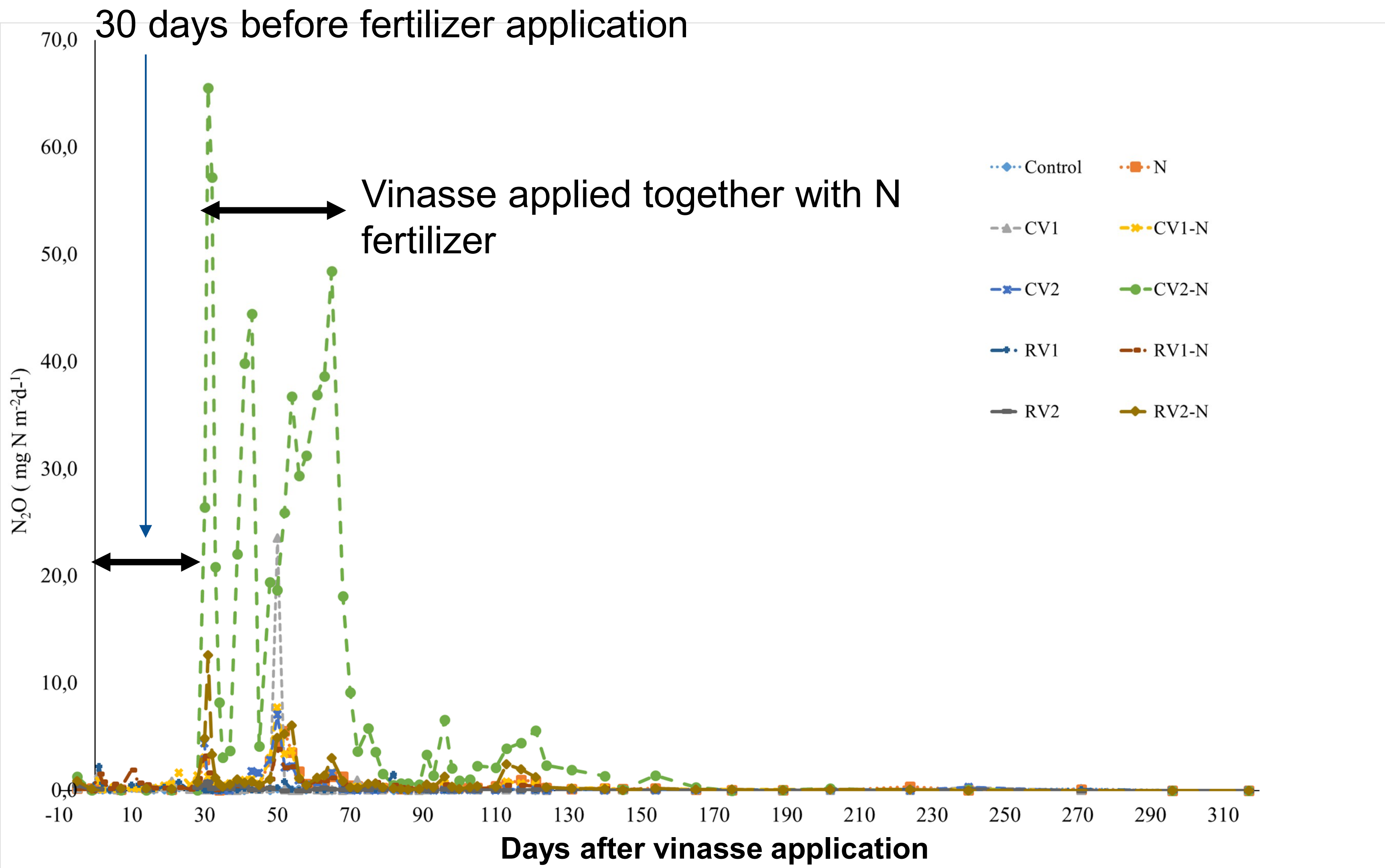
Treatment	$N\text{-}N_2O$ emissions		
	($g\ ha^{-1}$)	% applied N	Differences related to urea applied(%)
Zero N	1098 b		
UR	1924 a	0,69	
UR+DCD	1142 b	0,04	- 95
UR+DMPP	1112 b	0,01	- 98
PSCU	2213 a	0,93	+ 35

ANOVA and Tukey 5%

Soares et al., 2014 – Journal of Environmental Quality

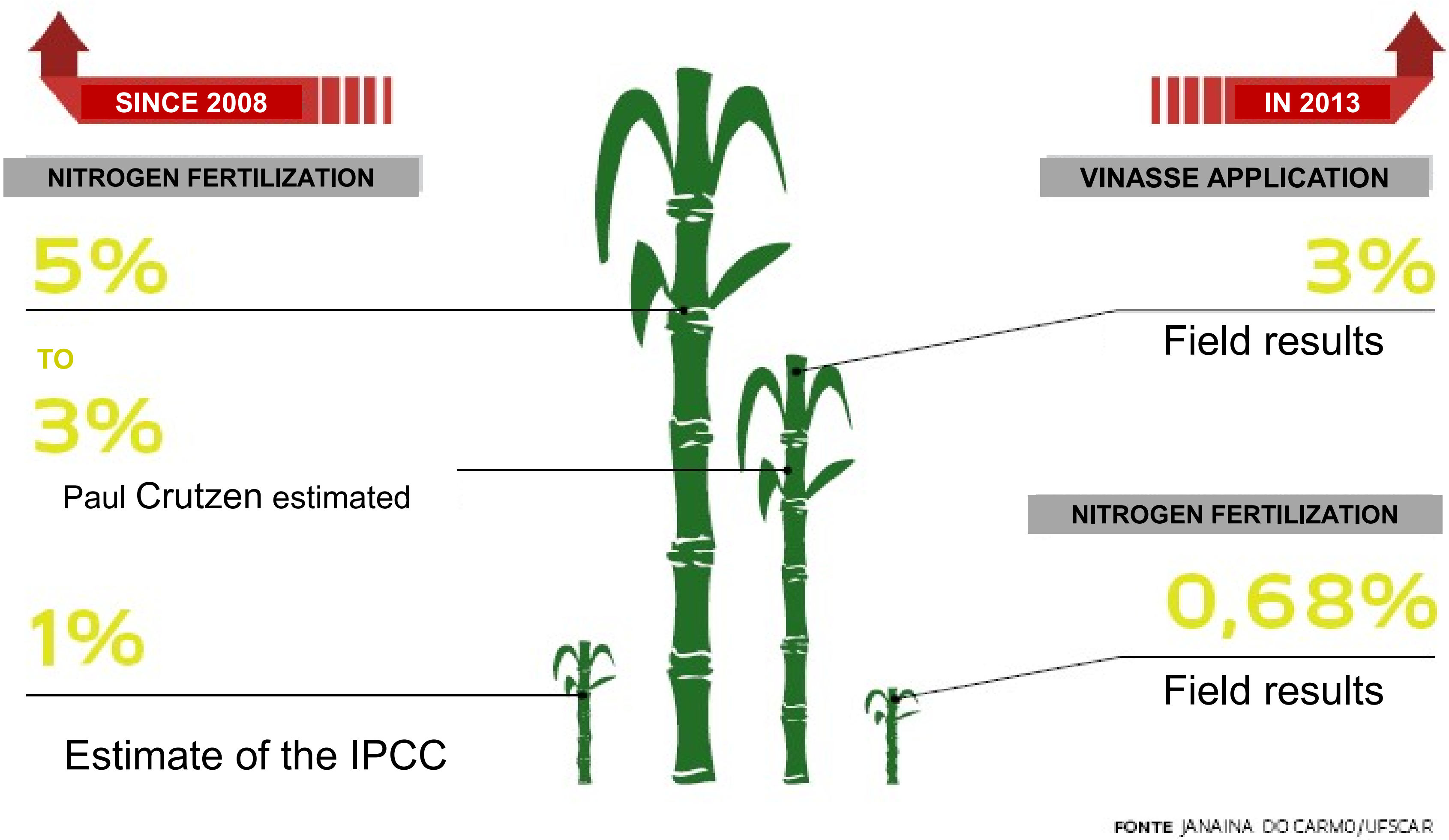
Vinasse applied in different time of N fertilization



Lourenço et al.2018 GCB-B

MINOR IMPACT IN THE ATMOSPHERE – general conclusion

THE DIFFERENCES BETWEEN THE EMISSIONS ESTIMATES AND FIELD STUDY



Agência FAPESP, 2013

N_2O, CO_2 and CH_4 EMISSIONS FROM AGRO-BIOFUEL PRODUCTION IN SÃO PAULO STATE, BRAZIL

Young Investigator PROGRAM - BIOEN

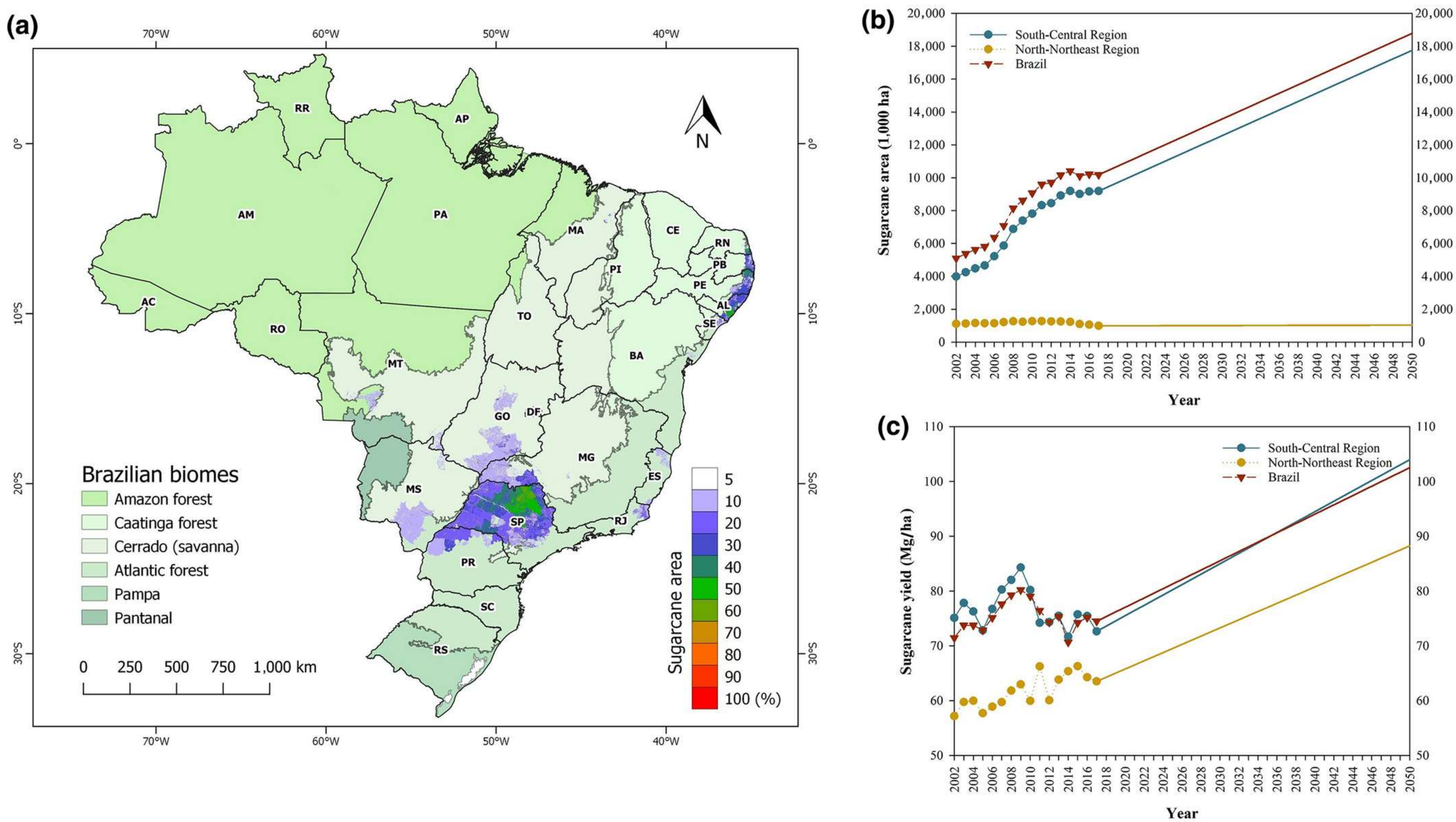
GLOBAL CHANGE BIOLOGY
BIOENERGY

GCB Bioenergy (2013) 5, 267–280, doi: 10.1111/j.1757-1707.2012.01199.x

Infield greenhouse gas emissions from sugarcane soils in Brazil: effects from synthetic and organic fertilizer application and crop trash accumulation

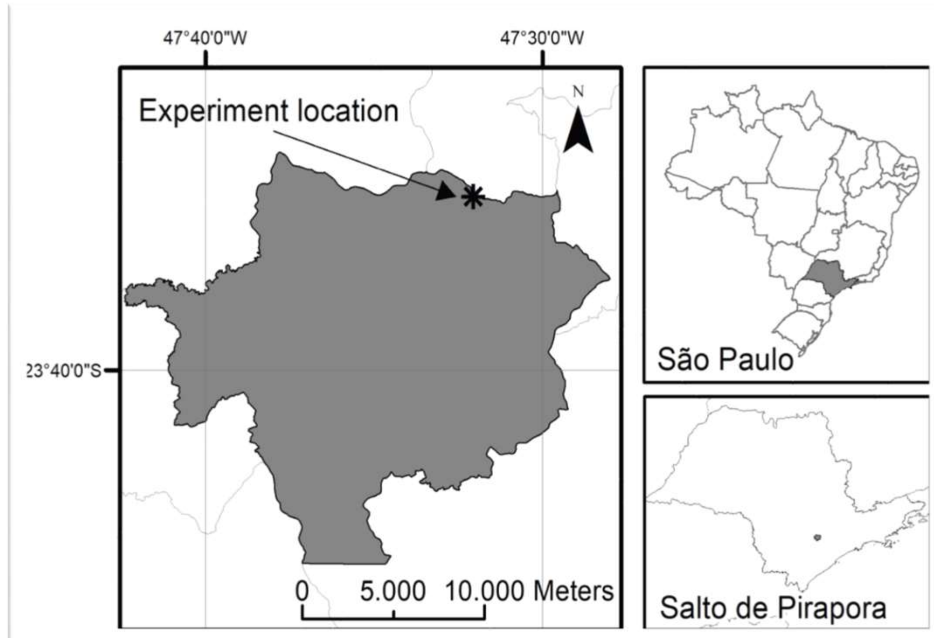
JANAINA BRAGA DO CARMO[*], SOLANGE FILOSO[†], LUCIANA C. ZOTELLI[‡§], ERACLITO R. DE SOUSA NETO[¶], LEONARDO M. PITOMBO[*], PAULO J. DUARTE-NETO[‡‡], VITOR P. VARGAS[‡], CRISTIANO A. ANDRADE[‖], GLAUBER J. C. GAVA[**], RAFFAELLA ROSSETTO[††], HEITOR CANTARELLA[‡], ANDRÉ E. NETO[§] and LUIZ A. MARTINELLI[¶]

Sugarcane production areas, Current and future area and yield trends from 2019 to 2050

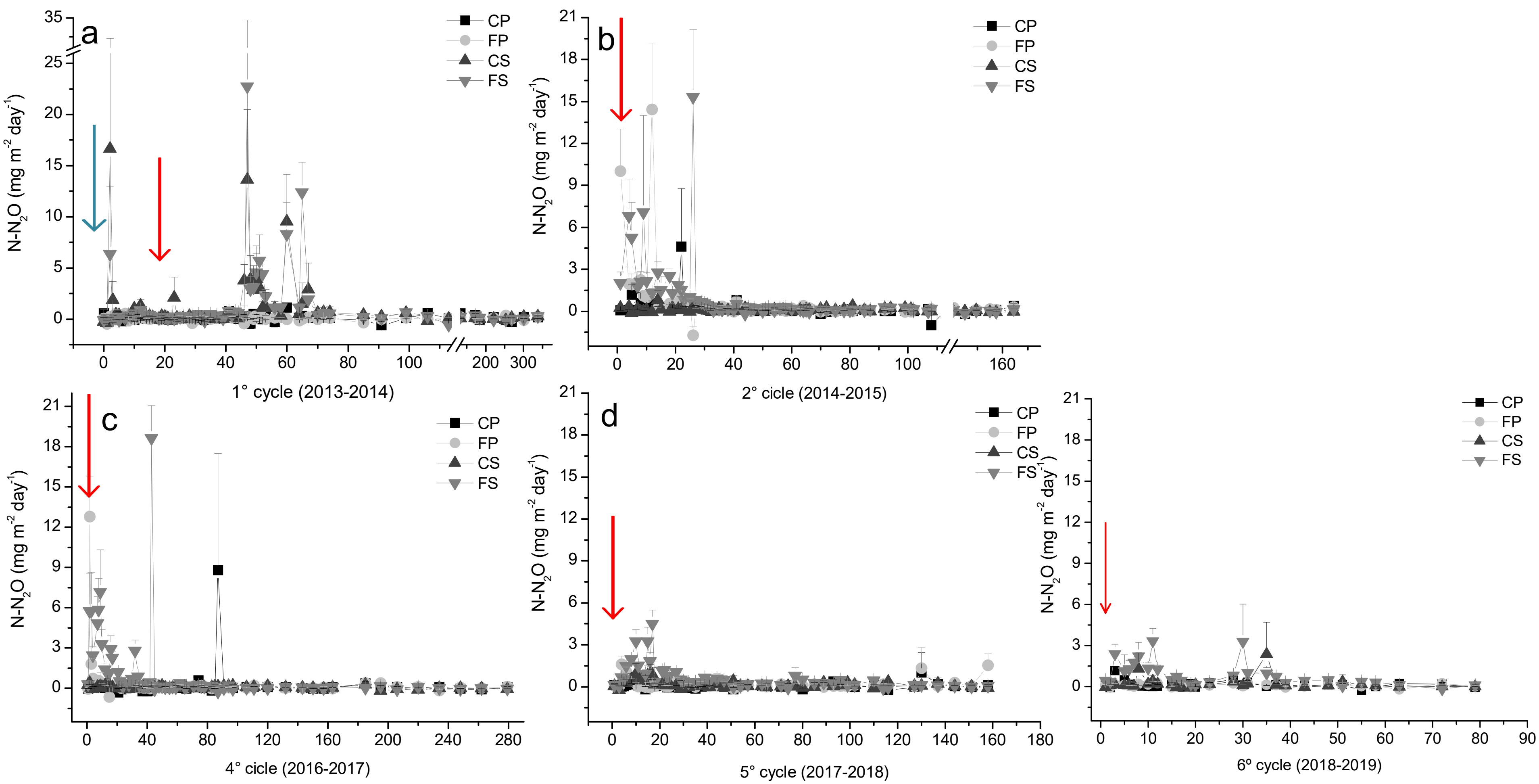


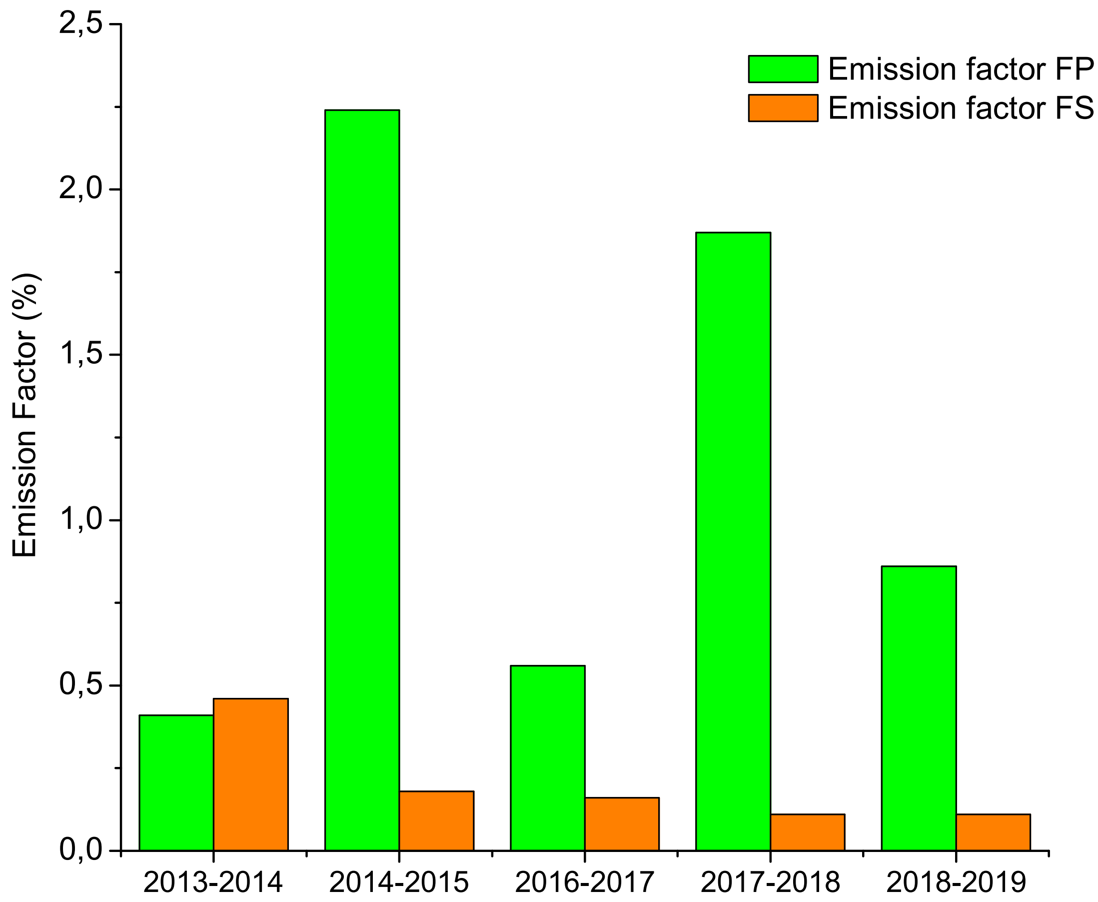
Soltangheisi et al, 2019 – Global Change Biology Bioenergy

Experiment:Sugarcane expansion into pastures



ID	Treatment	Soil Tillage	Fertilization
CP	Pasture control (baseline)	No	No
FP	Fertilized pasture	No	Yes
CS	Sugarcane control	Yes	No
FS	Fertilized sugarcane	Yes	Yes



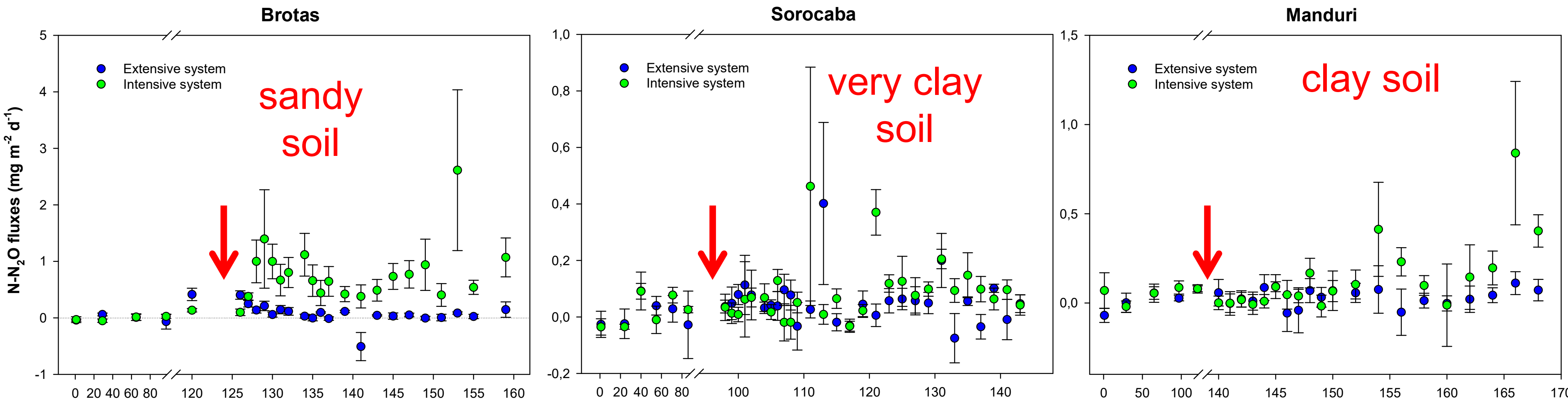


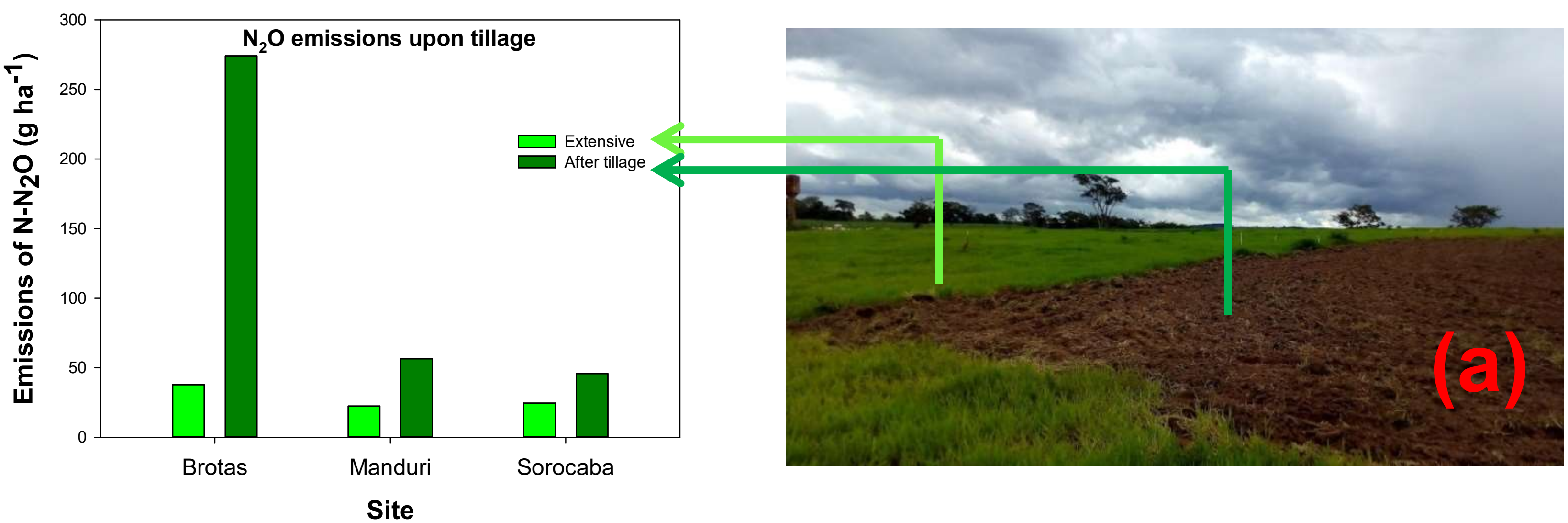
Emission Factor (%)
2,5
2,0
1,5
1,0
0,5
0,0
Emission factor FP
Emission factor FS
2013-2014
2014-2015
2016-2017
2017-2018
2018-2019

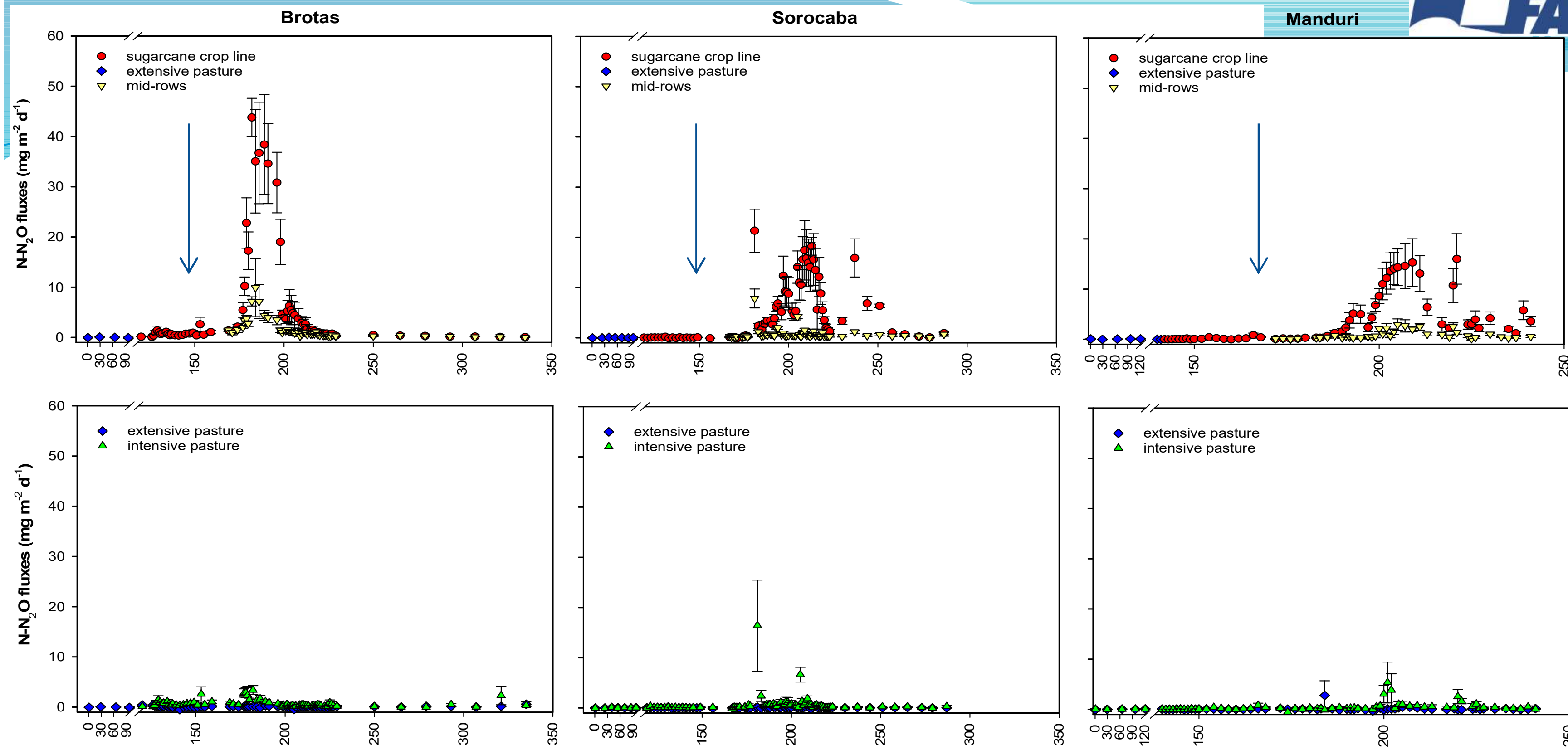
THEMATIC PROJECT
GRANTS BY FAPESP

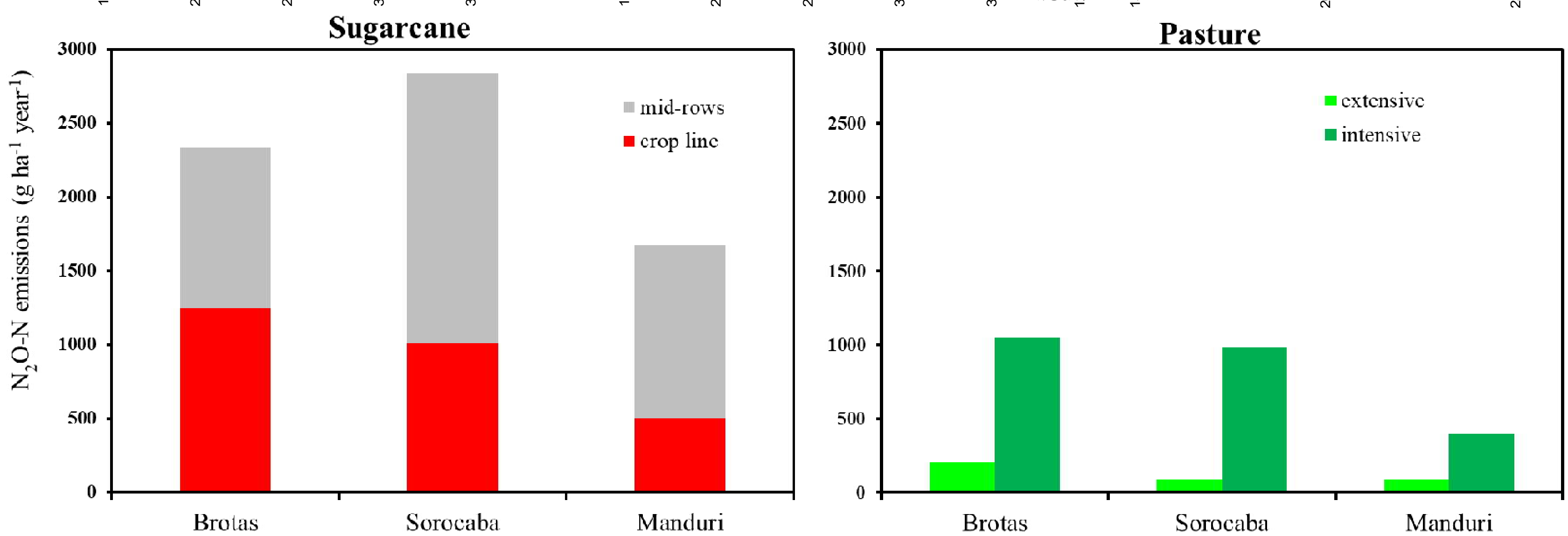
Environmental consequences of pasture-sugarcane conversion and intensification of pastures

Tillage effect after soil preparation






Brotas
Sorocaba
Manduri
sugarcane crop line
extensive pasture
mid-rows
extensive pasture
intensive pasture
N-N$_2$O fluxes (mg m^{-2} d^{-1})


Sugarcane
Pasture
mid-rows
crop line
extensive
intensive
N$_2$O-N emissions (g ha^{-1} year^{-1})
Brotas
Sorocaba
Manduri

CONCLUSIONS

Sugarcane is a good feedstock for biofuel production when practicing good sugarcane production management and taking certain precautions such as:

- The source of nitrogen fertilizers is important due to the particular soil type and management practiced during the sugarcane cycle

- Soil tillage and soil type are important factors determining emissions and minimizing soil movement is important for the future of sugarcane production.

- Vinasse application should be reevaluated for use in the future

Acknowledgments

FAPESP
Proc. 2015/18790-3

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