

Nitrous oxide fluxes from different nitrogen sources applied in upland rice in the cerrado goiano

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Introduction

Nitrous oxide (N₂O) is an important greenhouse gas, despite its low concentration in the atmosphere. It stands out due to the persistence of its molecule in the atmosphere and to its high global warming potential. Approximately 7% of the direct N₂O emissions within agricultural land comes from the use of synthetic fertilizers (MCTI, 2013). There is need to spread technologies that reduce the production of this gas. To this end it is necessary to investigate the different marketed nitrogen (N) sources, such as the protected ureias and in combination with other components (such as zeolites) that may contribute to reduce the emission of N₂O, being more efficiently used by the plants.

Material and Methods

The study was conducted at fazenda Capivara, experimental area belonging to Embrapa Rice and Beans, located in the municipality of Santo Antônio de Goiás-GO. The soil is Red Latosol (53% clay). The experimental design was completely randomized blocks ((5 + 1) x 4) corresponding to five N sources and the control (without application of N) and four replicates (total 24 plotes, 32 m² each). The test plant was upland rice in integrated crop-livestock system under zero tillage. Gas samples were collected using manual static chambers. Sam-

pling was made 0, 15, 30 minutes after the closing of the chambers. N₂O fluxes were measured by gas chromatography. Were held two fertilization, one soon after planting and another as topdressing, each 60 kg N ha⁻¹, were applied. The N sources used were: common urea (45%), urea + polymer (43%), urea + NBPT (N-45%), urea + inhibitor (44.6%), urea + zeolite (36% N). The emission factor was determined by the amount N lost in the form of N₂O (difference between the total emissions in the treatments with nitrogen fertilization and control) in relation to the total amount of N applied. The emission was expressed per unit of product and evaluated through the relationship between the total N₂O emissions and the amount of grain produced for each source used of N. The evaluations were conducted in the period of November 2, 2014 to November 10, 2015.

Results and Conclusions

Although nitrogenous fertilizers are costly and have potential to cause damage to the environment, these are commonly used in indiscriminated manner by large scale producers causing losses to the atmosphere and groundwater. Among the nitrogenous fertilizers used in Brazil urea is the most required for fertilization of crops because it has lower cost per kg of N. However, the use of urea is not always effective because heavy losses occur after its application. The source of urea + inhibitor presented the highest N₂O emission when compared to control and treatment of urea + polymer. The N sources treatments did not present significant differences for the other evaluated factors (Table 1). The association of the urea + polymer as a mechanism of reduction of uréase in nitrogen fertilization favored reduction of N₂O fluxes and lower emissions in the rice cultivation of uplands. However, the use urea + inhibitor, under the conditions of the study, was not effective in reducing the losses of N in the form of N₂O.

Table 1. Total emission, rice yield, N₂O emission per unit grain and emission factor from the application of different nitrogen sources in upland rice.

Treatments	Total emission (kg N-N ₂ O ha ⁻¹)	Rice yield (Kg ha ⁻¹)	N ₂ O emission per unit grain (g N-N ₂ O kg grain ⁻¹)	Emission factor %
Urea + inhibitor	2,59a	6421,59a	0,41a	0,81a
Urea + zeolite	2,09ab	6139,04a	0,34a	0,40a
Common urea	2,09ab	6144,40a	0,34a	0,40a
Urea + NBPT	1,94ab	5832,05a	0,34a	0,31a
Urea + polymer	1,79b	6064,39a	0,30a	0,24a
Control	1,61b	5517,01a	0,30a	-

*Means followed by the same letter in the column do not differ significantly (p-value > 0.05) by the Tukey test.

References

MCTI. **Annual estimates of greenhouse gas emissions in Brazil**. 2013. Available in: < http://www.mct.gov.br/upd_blob/0226/226591.pdf >. Access in: 20 may 2015.

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