

P4-241

[C3.3-4] Soil Management Strategy for Enhancing Crop Yields

## Levels of Ammonium and Nitrate in the Soil and Upland Rice Development as Affected by Cover Crops

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An important point to be considered in the no-tillage system (NTS) is the nature of the cover crop used. Besides, the decomposition of cover crops present on the ground may provide a greater availability of nutrients. The objective of this study was to evaluate the effect of cover crop species on the levels of nitrate and ammonium in the soil under no-tillage and conventional tillage systems, as well as upland rice yield.

The field experiment was conducted in Santo Antonio de Goias, GO. The regional climate is tropical savanna, Aw according to the Koppen classification. There are two well-defined seasons, normally dry from May to September (autumn/winter) and rainy from October to April (spring/summer), usually the growing season. The experimental design was randomized blocks with five cover crops with three replications. Each plot measured 6.0 m x 10 m. The cover crops used to grow rice in the no-tillage system were as follows: 1 fallow (spontaneous vegetation); 2 - *Panicum maximum*; 3 - *Brachiaria ruziziensis*; 4 - *Brachiaria brizantha*; and 5 - millet (*Pennisetum glaucum*). The soil sampling was performed with an auger on the upland rice sowing day (30 days after cover crop desiccation) and five additional times (7, 14, 21, 28 and 35 days) in all treatments and replications. Thus, eight sub-samples were collected in each composite sample from each plot at a depth 0-10 cm, which were homogenized by hand, labeled, wrapped in plastic bags, kept in a cooler with ice and sent to the lab for analysis. The analyses of mineral N were performed the same day of soil sample collection. From each soil sample, a representative aliquot of 20 g was removed and mixed with 60 ml of extraction solution KCl 2 mol L<sup>-1</sup>. After shaking for an hour and decanting the solid material, the supernatant was filtered using filter paper. This supernatant was used to quantify the levels of nitrate and ammonium. At the beginning of rice development (30 days after cover crop desiccation) and every 7 days (same day sampling of ammonium and nitrate in the soil) a total of seven assessments (0, 7, 14, 21, 28 and 35 days after rice sowing) were collected, and the dry matter of the cover crops was evaluated. The manual harvest of upland rice was conducted when approximately 90% of panicles had grains of typical mature coloration. Therefore, the grain yield was measured (unhulled grain weight collected at three central rows of five meters in each split-plot, eliminating 2.5 meters on each side of the plots from the usable areas, correcting their moisture content to 130 g kg<sup>-1</sup> and converting to kg ha<sup>-1</sup>). In this study, it could be observed that cover crops *Brachiaria brizantha*, *Panicum maximum* and *Brachiaria ruziziensis* in the NTS and *B. brizantha* and fallow incorporated in the CTS favored higher levels of nitrate in the soil. On the other hand, *B. brizantha* and fallow in the CTS and millet and *P. maximum* in the NTS favored the buildup of high levels of ammonium in the soil. The tillage system and the nature of cover crops could be used to achieve the desired levels and forms of nitrogen in the soil. Plowed millet and fallow had the statistically highest upland rice yields. However, plowed fallow that causes soil disturbances and is therefore not eligible for the no-tillage system does not seem to be a good option. On the other hand, the worst rice yields were found under cover crops *Brachiaria brizantha*, *Panicum maximum* and *Brachiaria ruziziensis* in the NTS (2356, 2857 and 2177 kg ha<sup>-1</sup>, respectively). Moreover, those grasses may have some allelopathic effect that hampers aerobic rice plant development. Therefore, from the data obtained, *Brachiaria brizantha*, *B. ruziziensis* and *Panicum maximum*, despite their importance in NTS for producing large amounts of biomass, do not seem to be the ideal cover crop for upland rice. However, in an agricultural system, we could infer that before upland rice, it is important to introduce millet. After upland rice harvesting, perennial forage, such as *Panicum maximum*, *Brachiaria brizantha* or *B. ruziziensis*, could be introduced to achieve a great amount of cover crop in the beginning of the following rainy season and to cultivate another cash crop.

*Keywords* : *Brachiaria brizantha*, *Brachiaria ruziziensis*, *Panicum maximum*, millet, fallow, soil management