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Nitrogen balance of a fertigated coffee crop

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The major world coffee producer is Brazil that consumes large quantities of nitrogen (N) as fertilizer for this crop every year. The savanna areas (cerrado) of the central region are emerging as coffee producers. In this flat region the fertigation is a very common practice were high N rates are applied a great number of times. Probably this splitting is controlling N losses to the environment, but these rates higher than those applied in traditional coffee growing regions probably lead to expressive losses. A good coffee bean production is possible with lower N fertilizer, making the production system more sustainable. In order to determine the most efficient dose of N fertilizer to be applied to an adult coffee crop and the losses when using different N amounts, a nitrogen balance was calculated using the isotopic dilution technique. The experiment was carried out over a complete coffee cropping cycle (2008/2009) in a field of low soil fertility in the Brazilian cerrado. Rates of 0, 200, 400, 600 and 800 kg ha^{-1} $year^{-1}$ of 15N-labeled urea (1.035 atom % 15N) were applied via fertigation, divided equally every 14 days over the cycle. Treatments were distributed in a randomized design with four replicates. The following compartments were considered: whole plant (leaf, branch, stem, fruit and root), reserve (litter and soil) and loss (leached solution and other not evaluated losses). Samplings were made at harvest time for the assessment of dry matter, N concentration and 15N abundance to calculate for each compartment the quantity of N derived from fertilizer (QNdff, kg ha-1) and percentage of QNdff per N rate applied, or N recovery (R, %). The green coffee beans yield also was measured. The results allow us to conclude that the most efficient N rate was 200 kg ha-1 year-1, because it presented the lowest losses (R = 15% and QNdff = 30 kg ha-1N) and highest N recoveries in the whole plant (R = 61%) and litter (R = 21%). Moreover, this rate is approximately the same N amount exported through green coffee beans (171 kg ha-1 on average). The less sustainable rate was 800 kg ha-1 year-1, which presented the greatest loss (R = 41% and QNdff = 330 kg N ha-1), and the lowest N recovery in whole plant (R = 27%). Although the doses of 800 and 600 kg ha-1 year-1 N showed the largest QNdff to the whole plant (QNdff = 216 and 245 kg ha-1 year-1 N, respectively) and the reserves (245 and 176 kg ha-1, respectively for the same doses), they did not increase green coffee beans yield, which presented no significant difference between treatments with an average of 3,590 kg ha-1.