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Reduction of banana (*Musa* AAA cv Grande Naine) leaf photosynthesis by *Radopholus similis*

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ABSTRACT
Objective: to determine the effect of *Radopholus similis* on banana (*Musa* AAA cv. Grande Naine) leaf photosynthesis.
Methodology and Results: Four experiments were carried out under lathhouse conditions. *In vitro* plants were sown in pot of 1.8 L volume containing a soil (sterilized or unsterilized) from a commercial banana farm. Experiment 1: four treatments were evaluated. The treatments consisted of plants on unsterilized and sterilized banana soil without and with the inoculation of 500 (506 ± 18) *R. similis* per pot. During the three measuring times (7 am, 10 am, and 1 pm), at 45 days after inoculation, the highest photosynthesis rate was observed in the plants free of nematodes and the lowest in those plants inoculated with *R. similis*. In the evaluation at 10 am a reduction of 46% (P= 0.0307) in the photosynthesis rate was found on plants inoculated with *R. similis* that were grown in the sterilized banana soil. In experiment II: five treatments were evaluated on sterilized banana soil. One treatment was non-inoculated (control) and in the others, each plant was inoculated 15 days after sowing with 500 (509 ± 21), 1000 (1049 ± 34), 1500 (1526 ± 39) or 2000 (2056 ± 67) *R. similis*. After 75 days of the inoculation, from the six photosynthesis evaluation times (6-7, 8-9, and 10-11 am or 12-1, 1-2 and 2-3 pm) with exception of that at 2-3 pm, the highest photosynthesis rate was observed in the plants free of nematodes. Reductions in the photosynthesis rate with nematode inoculation varied between 12 and 36% at 6-7 am, between 13 and 57% at 8-9 am, between 32 and 57% at 10-11 am, and between 16 and 65% at 12-1 pm, and between 13 and 47% at 1-2 pm. The photosynthesis rate decreased linearly as the number of *R. similis* inoculated increased in the evaluations of 8-9 (P= 0.0070) and 10-11 am (P= 0.0049) or 12-1 pm (P= 0.0048) and 1-2 pm (P= 0.0255). In experiment III: two treatments were evaluated in sterilized banana soil in which the plants of one treatment were inoculated 19 days after sowing with 1500 (1564 ± 49) *R. similis* and the others were the control. A photosynthetic light response curve was determined at 75 days after inoculation showing that the area under curve of the potential assimilation rate of the plants inoculated with *R. similis* was reduced (P= 0.0153) by 70% compared to non-inoculated plants. In experiment IV: three treatments were evaluated where the plants of two treatments were sown in sterilized banana soil. One treatment was inoculated with 2000 (2078 ± 63) *R. similis* per pot, 21 days after sowing, and the other had no inoculation. The remaining treatment was set up in

unsterilized soil without nematode inoculation. The net assimilation rate curve before nematode inoculation differed (P= 0.0072) among treatments. A reduction of 33% in the accumulated net assimilation rate across the sequence of light points (0-2200 µmol m^{-2} s^{-1}) was evidenced on the plants cultivated on banana soil without sterilization, which was infected with residual *R. similis* on the soil. The net assimilation rate curve at 4 (P< 0.0001), 11 (P= 0.0340) and 25 (P= 0.0127) days after nematode inoculation was higher on the plants free of nematodes.

Conclusion and Application of results: In the four experiments, the lowest photosynthetic rate was found in the plants infected by *R. similis*. This confirms that the infection or parasitism of banana roots by *R. similis*, independently of if there are obvious root and foliage symptoms, consistently it reduces their photosynthesis rate, which in a long term will reduce crop performance. Therefore, nematode population must be monitored during the crop cycle to apply control measures in time in order to prevent production losses.

Keywords*:* banana, *Musa* AAA, nematodes, photosynthesis, *Radopholus similis*