Can Successive Generations of Banana Plants be Protected from Nematode Attack by a Single Inoculation with Beneficial Endophytic Fungi?

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Abstract

Increasing interest in biocontrol of crop pests for environmental and human health reasons have opened the door to a great variety of potential biocontrol agents from a range of environments. Among these, beneficial bacterial and fungal endophytes, i.e. microorganisms that colonize plant tissue without causing disease symptoms and help protect the plant against diseases or pests, are of special interest. This is in part due to the fact that they can be isolated, re-introduced and re-isolated from the very tissues where pests and diseases are known to attack. In the case of roots and nematodes, this is especially interesting, because an introduction of such beneficial organisms into root tissues prior to planting would avoid the need for soil applications of biocontrol agents in great quantities, as endophytes are already "on site" and ready to protect the crop. Beneficial endophytic fungi have been identified for the management of the burrowing nematode, *Radopholus similis*, in banana. These fungi were isolated from healthy roots of bananas grown in areas where natural nematode suppression was either suspected or proven. Once isolated, fungi were screened for nematode suppression in greenhouse trials and later in field experiments. These experiments proved that the endophytes chosen are effective in protecting banana plants not only at the greenhouse level, but also under field conditions. However, as banana is a perennial crop, with re-plantings occurring only at lengthy intervals, the question of how to protect second and subsequent generations remains. Evidence of a transfer of nematode suppression provided by individual fungal endophytes from one banana generation to the next has been found. This data provides incentives to pursue a long-term nematode-bio-control approach in banana using beneficial endophytic fungi.

Keywords: Biocontrol, *Musa* (AAA), nematode management, suppression, transfer

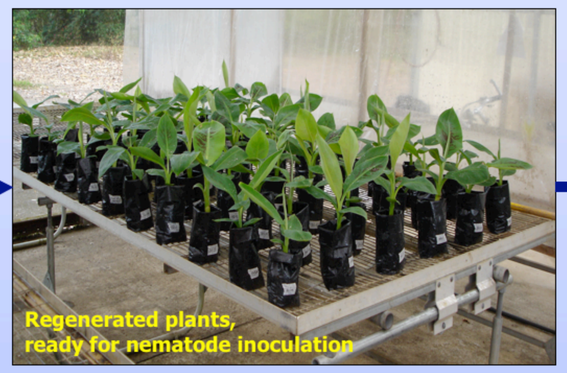
Objectives

To investigate whether the suppression of the burrowing nematode (*Radopholus similis*), caused by a single pre-planting inoculation of one of four mutualistic endophytic fungi (*Trichoderma atroviride* isolates MT-20 and S2 and non-pathogenic *Fusarium oxysporum* isolate S9 and P12), is transferred to successive generations of banana plants (*Musa* (AAA) cv. Valery) in the field and at the greenhouse level.

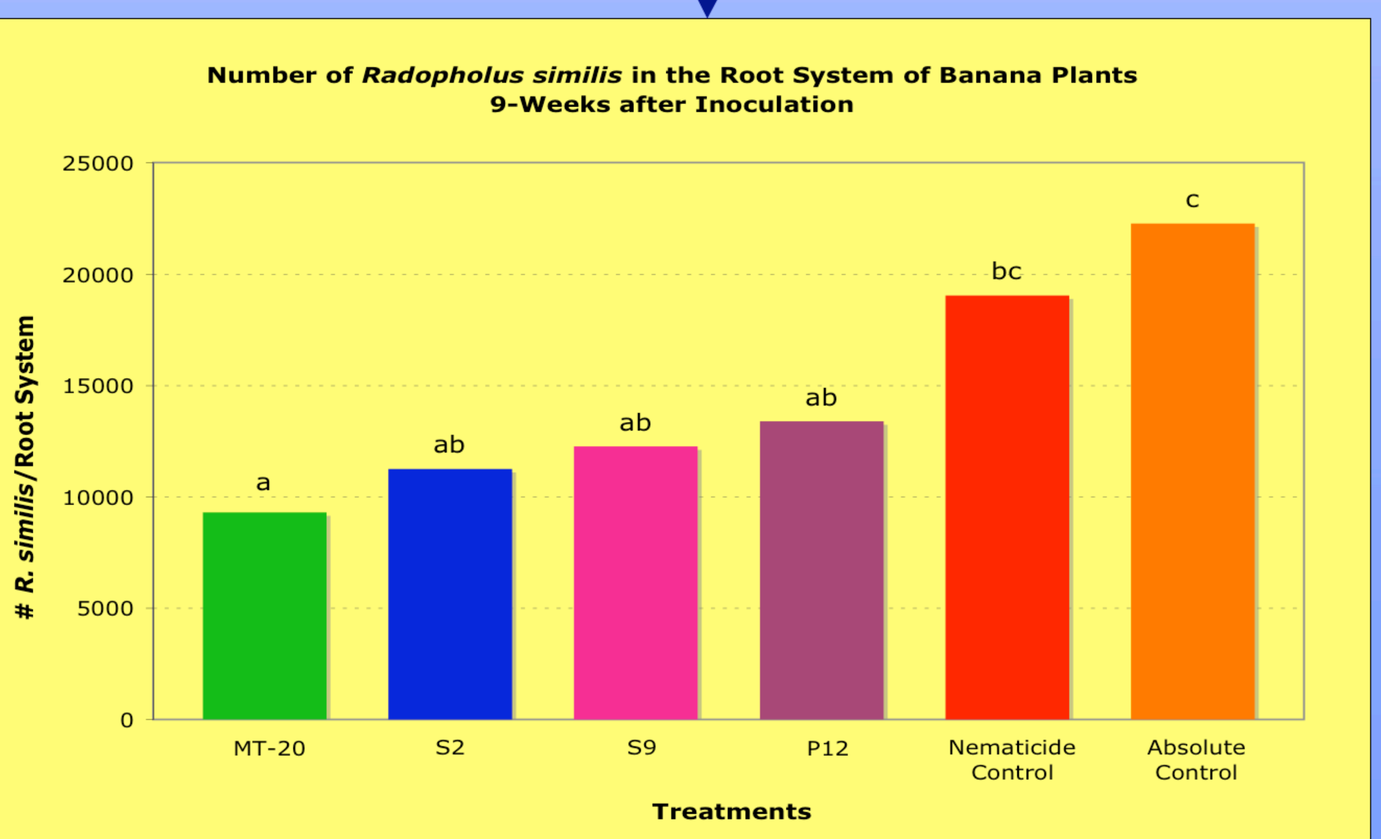
Materials and Methods

Suckers studied at the greenhouse level were retrieved from a filed trial running parallel to this study. The aim of the field trial was to evaluate the effect of *Radopholus similis* antagonistic fungal endophytes at the field level, compared to an absolute control and a nematicide control. Two thirds of the plants used in the trial were inoculated with one of four different mutualistic endophytic fungi (MT-20, S2, S9 or P12). Half of the non-inoculated plants served as absolute controls, while the other half were treated with nematicides in the field, to serve as nematicide controls. Six treatment blocks were established in the field. Twelve weeks after planting of the field experiment, one sword sucker was collected from 20 plants in each treatment block. To evaluate transfer of nematode suppression caused by endophytes, the corms of sword suckers were treated as described in the following schema:

10 Weeks



9 Weeks



Conclusions

- The number of *R. similis* in roots of plants generated from sword suckers of 'Valery' banana plants, inoculated with a single mutualistic fungal endophyte, prior to planting in the field, was significantly lower than in roots of control plants and also lower than in roots of those plants treated with nematicides in the field.
- Where and when a mutualistic fungal endophyte gets established and protects plants from nematode attack in the field, this protection is transferred onto successive generations.
- Therefore successive generations of banana plants can be protected from nematode attack by a single inoculation with beneficial endophytic fungi.

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