

Promising native *Trichoderma atroviride* (BC0584) as a biocontrol agent in seed coating for reducing Fusarium damping-off on maize crop in Belgium

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Maize is one of the most commonly grown crops in Belgium and is primarily cultivated as animal feed. At sowing, maize seeds are coated with synthetic fungicides and/or repellents in order to protect them from damping-off or from birds. The aim of this study was to identify one biological control agent (BCA) which is naturally able to control soil-borne fungal agents causing damping-off. More than 1,000 native fungi were isolated from Belgian maize agroecosystems. *In vitro* screenings were carried out to determine their antagonistic activities against *Fusarium avenaceum* and *F. culmorum* fungi at 25°C, 15°C, 10°C and 5°C and their abilities to produce lytic enzymes. This led to the identification of the forty best BCA candidates. The BC0584 strain with the highest antagonistic activity was identified as *Trichoderma atroviride*. Its ability to control soil-borne fungal damping-off pathogens was then tested *in planta*. Bioassays conducted in greenhouses revealed that inoculating the substrate with the *T. atroviride* endophytic strain significantly improves the emergence rate of seedlings infected by *F. avenaceum* or *F. culmorum*, from 20.0 ± 10.0 % to 85.0 ± 11.2 % and from 60.0 ± 7.1 % to 95.0 ± 8.7 %, respectively ($P < 0.001$). Two field trials were then performed during the season 2017 and the coating of maize seeds with *T. atroviride* conidia significantly increased the emergence rate of naturally-infected seedlings by 28.2 ± 5.8 % and by 23.6 ± 9.6 % compared to untreated seeds. Modes of action and required conditions to ensure biocontrol in fields have still to be investigated. In order to develop an efficient and viable formulation of the BCA, and to consider its concrete development from production, and storage to its application on the field, three seed coating formulations were compared under controlled conditions. One slurriable powder allows to maintain conidia viability to $84.1\% \pm 14.3$ % over a six month-storage period at 4°C in the dark. This formulation allows for spores to be easily, quickly and cheaply produced in large amounts, with inexpensive components, while manufacturing and coating of maize seeds are easy and rapid. This coating is also compatible with a conventional seeder. This is the first study showing the potential of a *T. atroviride* native strain to control Fusarium damping-off on maize crop in Belgium. Formulating this promising BCA into a slurriable powder could offer an efficient alternative to synthetic fungicides for maize seed treatments. In a broader context, this formulation could also be adapted for other fungal seed coated BCAs.