LIÈGE université
Gembloux
Agro-Bio Tech

Le Corps professoral de

Gembloux Agro-Bio Tech - Université de Liège vous prie

de lui faire l'honneur d'assister à la défense publique de la dissertation originale que

Monsieur NGUYEN Minh Luan,

Titulaire d'un diplôme de *M. S. in life science*,

présentera en vue de l'obtention du grade et du diplôme de

DOCTEUR EN SCIENCES AGRONOMIQUES ET INGENIERIE BIOLOGIQUE,

le 22 octobre 2018, à 10 heures précises (personne ne sera admis après cette heure),

en l'auditorium GP (Géopédologie, bât. 52),

Avenue Maréchal Juin à 5030 GEMBLOUX.

Cette dissertation originale a pour titre :

« Biostimulant effects of rhizobacteria on wheat growth and nutrient uptake under contrasted nitrogen supplies ».

Le jury est composé comme suit :

Président : Prof. P. LEBAILLY, Professeur ordinaire,
Membres : Prof. P. DELAPLACE (Promoteur), Prof. P. du JARDIN (Copromoteur), Prof. M. ONGENA, Prof. B. BODSON, Prof. H. JIJAKLI, Prof. S. SPAEPEN (KUL), Prof. C. HERMANS (ULB).

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Summary

Plant growth-promoting rhizobacteria (PGPR) are increasingly used as microbial biostimulants. Hereby, the capacities of PGPR to promote plant growth and nutrient uptake in wheat were evaluated under contrasted mineral N fertilization rates under gnotobiotic, greenhouse, and field conditions. Six PGPR strains were employed for the tests, including three laboratory strains *Bacillus amyloliquefaciens* GB03 (BamGB03), *B. megaterium* SNji (BmeSNji), *Azospirillum brasilense* 65B (Abr65B), and three commercially formulated trains, *B. amyloliquefaciens* IT45, FZB24, and FZB42.

Under gnotobiotic conditions using sterile soil, all of the strains significantly increased plant biomass 14 days after inoculation irrespective of the N fertilization rates. Under greenhouse conditions, the highest growth promotion was recorded under moderate N supply (50N), followed by full N dose (100N), while no significant effect of the inoculant was observed in the absence of N fertilizer (0N). At 50N, the biomass was most significantly increased in specific plant parts, i.e. in roots (increase up to +45%) 30 days after inoculation with Abr65B and in the ears (19–23% increase) with BamGB03, BmeSNji, Abr65B 60 days after inoculation. At 0N, FZB24 was able to significantly increase root biomass of spring wheat up to +31% 30 days after inoculation. Under field conditions, FZB24 significantly increased grain yields by 983 kg ha^{-1} (14.9%) as compared to non-inoculated controls at 0N in 2014 field trials. However, in 2015 field trials, FZB24 was not able to replicate the previous positive results, likely due to the low temperatures occurring during and after the inoculations at tillering stage.

The increase in plant biomass caused by PGPR inoculation was paralleled with lowered concentrations of several nutrients in the same organs of plants growing under greenhouse conditions. Specifically, the increases in root and ear biomass caused by BmeSNji, Abr65B were paralleled with lowered concentrations in N, P, Mn, and Cu (organ- and strain-specific). Regarding IT45 and FZB24 inoculations, when the increase in biomass was lower, only two nutrients (P and K) exhibited a lowered concentration while other nutrient (Fe, Mn, Zn, and Cu) concentrations were significant increased. In contrast, the highest increases in plant biomass stimulated by PGPR inoculations goes along with higher total nutrient content and nutrient uptake efficiency.

The results are discussed in the perspective of PGPR implementation in contrasted cultivated systems and their interaction with fertilizer application.