Effects of Vibrance Gold® on soil parameters during wheat development

European Root Health Forum 2015

S. Piutti[a,b], H. Clivot[a,b], V. Braun[c], O. Borde[c], S. Slezack-Deschaumes[a,b]

[a] Université de Lorraine, Laboratoire Agronomie et Environnement, UMR 1121, TSA 40602, 54518 Vandœuvre cedex, France
[b] INRA, Laboratoire Agronomie et Environnement, UMR 1121, TSA 40602, 54518 Vandœuvre cedex, France
[c] Syngenta France SAS, 1 avenue des Prés, 78286 Guyancourt, France

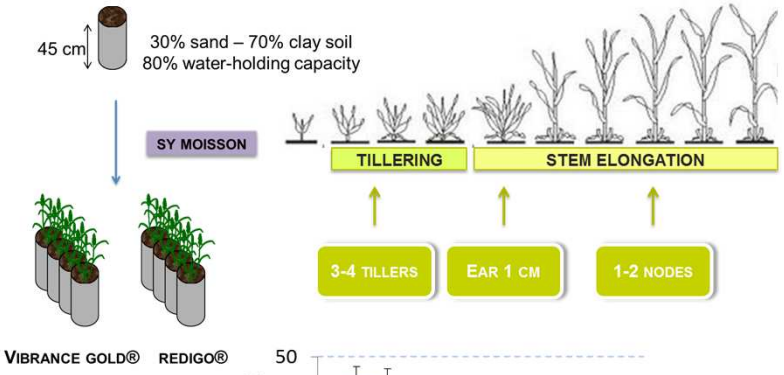
Introduction :

Nitrogen is a limiting nutrient for vegetative growth supporting leaf area development and photosynthesis. Vibrance Gold® applied as seed treatment has a beneficial effect on wheat growth (Slezack-Deschaumes et al.). One hypothesis is that Vibrance Gold®, by modulating root architecture traits related to nutrient acquisition, could improve root N uptake. A second hypothesis is that seed treatment acts as a biostimulant that induced some soil microbiological functions such as organic matter decomposition and then, improve the bioavailability of nutrients for plant uptake.

Material and methods :

At each growth stages (3-4 tillers, ear 1cm and 1-2 nodes), rhizosphere soils were sampled for Redigo (100 g l^{-1} prothioconazol) and Vibrance Gold® (50g l^{-1} sedaxane) treatments. The following soil parameters were measured :

- Hot water extractible carbon (HWC) and nitrogen (HWN)
- Microbial biomass carbon (MBC) and nitrogen (MBN)
- Enzyme activities linked to biogeochemical cycles (carbon, nitrogen, phosphorus and sulfur)



Results and discussion :

HWC was significantly reduced (-74%) at the 1-2 nodes stage in Vibrance Gold® treatment compared to Redigo treatment (Figure 1a). This soil C pool constitutes a source of C and energy for soil heterotrophic microbial biomass. As this C pool is linked to rhizodeposition, the largest decrease of HWC in the Vibrance Gold® treatment could result from a greater reduction in the rhizodeposition compared to Redigo treatment. No effect of the seed treatment was evidenced at any development stage on MBC (data not shown).

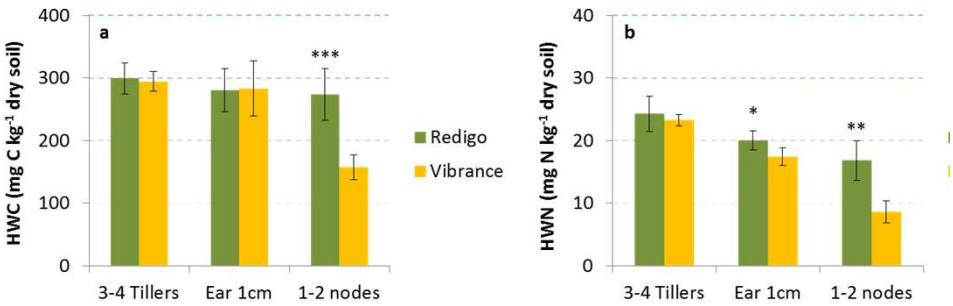


Figure 1 : Evolution of soil extractible carbon (HWC, figure a) and soils extractible nitrogen (HWN, figure b) content (mean value ±SE, n=4) in Redigo and Vibrance Gold® treatments. (Significant levels : * p<0.05; ** p<0.02; *** p<0.001)

This greater N immobilisation in microbial biomass in the Vibrance Gold ® treatment explained the significant decrease of the C:N ratio of microbial biomass at the last development stage (Figure 3). No positive effect of Vibrance Gold® treatment was evidenced on the microbial enzyme activities related with C, N, P and S cycles.

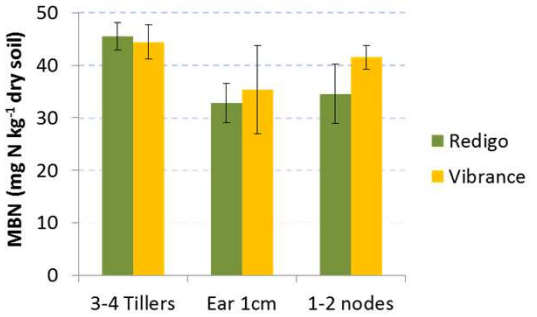


Figure 2 : Evolution of microbial biomass nitrogen (mean value ±SE, n=4) in Redigo and Vibrance Gold® treatments (Significant levels : * p<0.05; ** p<0.02; *** p<0.001)

HWN (soluble organic and inorganic N forms) decreased significantly in the Vibrance Gold® treatment during stem elongation (Figure 1b), suggesting a greater uptake of soil mineral N by plants and/or a larger microbial N immobilisation (Figure 2).

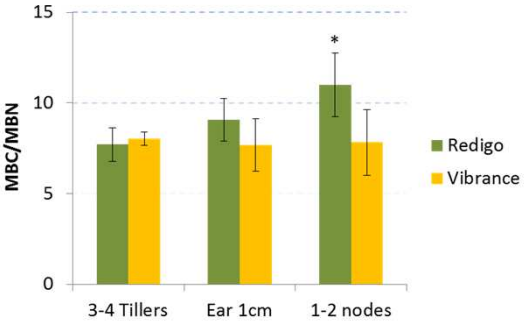


Figure 3 : Evolution of the C:N ratio of microbial biomass (mean value ±SE, n=4) in Redigo and Vibrance Gold® treatments (Significant levels : * p<0.05; ** p<0.02; *** p<0.001)

Conclusion :

Soil parameters evolved during wheat developement. The strong decrease of soil carbon and nitrogen contents in Vibrance Gold® treatment suggest that : (i) the root soluble C content is reduced due to changes in plant C allocation, (ii) the acquisition of soil N by the plant is more efficient due to changes in the root morphology.

INRA SCIENCE & IMPACT

UNIVERSITÉ DE LORRAINE