Assessing the Absorption Potential by Establishing the Hierarchy of *Zea Mays* Root System

Roxana VIDICAN, Vlad STOIAN* and Ioan ROTAR

Department of Plant Culture. University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca

*Corresponding author: vlad.stoian@usamvcluj.ro

Bulletin USAMV series Agriculture 72(2)/2015

Print ISSN 1843-5246; Electronic ISSN 1843-5386

DOI 10.15835/buasvmcn-agr: 11577

ABSTRACT

Maize has good biological particularities to exploit a high variety of agricultural land in different climatic conditions, due to a complex root system. The exploration of soil by roots developed by maize is dependent on the mycorrhization level, that increases the absorption capacity of nutrients from soil solution. The current experiment assesses the differences of mycorrhization colonization in the maize roots, by levels of radicular architecture. The level's division is performed based on the ramification point, by observing the hyphal network and arbuscular circuit. The development of intraradicular hyphal networks is stronger in the aged areas of the root, while in the freshly formed segments the arbuscular impermanent structures are more visible. In the segments with high colonization intensity high soil nutrient absorption phenomenon occurs, while in the areas with lots of arbuscules predominant is the intense transfer of minerals between the two partners.

Keywords: *Zea mays*, absorption potential, root surface, mycorrhizal colonization.

INTRODUCTION

In the current context of agriculture, corn is presented as one of the most cultivated plants, widely used in the human nutrition, animal feed and industry. Biological particularities of maize offers to this crop the potential to exploit a high variety of agricultural land in different climatic conditions. The high capacity of resistance to climatic stresses is due to a complex root system and a good expansion in the soil.

AIMS AND OBJECTIVES

The exploration potential of rooting and branching of corn plants, along with the evaluation of access potential for mycorrhizal symbiotic partnership may offer a viable serie of mathematical models to calculate the absorption potential of nutrients from the soil. Identifying areas with highly potential roots accessing

nutrients resources from soil serves to redefine the moment of fertilization and the decrease of technological inputs.

MATERIALS AND METHODS

The experiment assesses the root system of maize plants from a functional perspective, separating roots depending on the area of insertion. Classes are separated based on the branching patterns (C r I, C r II, C r III). Assessment of the mycorrhization level is performed based on the indicators proposed by Trouvelot et al. (1986, quoted by www2.dijon.inra.fr), frequency (freq), colonization intensity in the system (int sys) and in root segments (int seg), arbuscularity in the system (arb sys) and in root segments (arb seg), rounded by the degree of colonization (col deg) specific to each analyzed radicular system (Stoian, 2011). Statistical analysis were conducted

Tab. 1. Mycorrhizal parameters in all branching levels

Root architecture	Freq	Int sys	Int seg	arb seg	Arb sys	Col deg
C r I	93.07 ^a	31.98 ^a	34.60 ^{ab}	4.12 ^b	1.34 ^c	29.75 ^a
C r II	83.49 ^{ab}	27.41 ^a	31.88 ^b	30.58 ^a	8.37 ^b	26.78 ^a
C r III	74.57 ^b	35.86 ^a	38.97 ^a	35.29 ^a	12.65 ^a	22.99 ^a

Note: Different letters between parameters denote significant differences (Tukey.HSD test, $p < 0.05$).

with Tukey.HSD test, from “agricolae” package (de Mendiburu et al., 2014) in R Studio (Team R, 2014).

RESULTS AND DISCUSSION

The colonization frequency is proportionally decreasing with the degree of ramification, doubled by the reduced fluctuation of the colonization intensity in the radicular system and mycorrhized fragments. The arbuscular circuit is developing especially in the freshly formed roots, indicating the transfer interface creation between the two partners. Significant differences are noticed when assessing the complete arbuscular system. The degree of colonization has a reduced variance, in the areas with low penetration of the radicular cortex noticing a good intraradicular development of the fungi's hyphae.

Ranking the functional divisions indicates a high absorption potential in root hairs??? developed in the low-order ramifications of the root, with a strong active mycorrhizal circuit. In the main root cortex there is a well developed

senescent micorizian circuit with a lower absorption potential, but with a high capacity to transfer nutrients from the absorbing activity of fresh created root hairs.

CONCLUSION

The success of maize as a crop plant depends on the branching capacity of the root's system, the absorption potential based on mycorrhizal symbiosis being a eligible reference for biological modelling techniques.

REFERENCES

1. de Mendiburu F (2014). Agricolae: Statistical Procedures for Agricultural Research. R package version 1.2-1. <http://CRAN.R-project.org/package=agricolae>.
2. Stoian HV (2011). Studiul simbiozelor micoriziene în unele ecosisteme de pajiști din zona Munților Apuseni. Teză de doctorat – USAMV Cluj- Napoca.
3. Team R (2014). RStudio: Integrated Development for R. RStudio, Inc., Boston, MA. URL <http://www.RStudio.com/>ide.
4. ***www2.dijon.inra.fr.