



HAL
open science

Behavior of mycorrhizal communities in agroforestry: Case of the walnut plantations associated with maize and faba bean

Babacar Thioye, Lisa Castel, François Hirissou, Isabelle I. Trinsoutrot-Gattin, Marc Legras

► **To cite this version:**

Babacar Thioye, Lisa Castel, François Hirissou, Isabelle I. Trinsoutrot-Gattin, Marc Legras. Behavior of mycorrhizal communities in agroforestry: Case of the walnut plantations associated with maize and faba bean. 4th World Congress on Agroforestry, May 2019, Montpellier, France. <10.3390/su10093337>. <hal-02565247>

HAL Id: hal-02565247

<https://normandie-univ.hal.science/hal-02565247v1>

Submitted on 6 May 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



HAL Authorization

Babacar THIOYE^{1,2}, Lisa CASTEL^{1,2}, François HIRISSOU³, Isabelle TRINSOUTROT-GATTIN^{1,2}, Marc LEGRAS^{1,2}

¹ UniLaSalle, Unité de recherche AGHYLE UP 2018.C101, campus Rouen 3 rue du Tronquet 76130 Mont Saint Aignan, France.

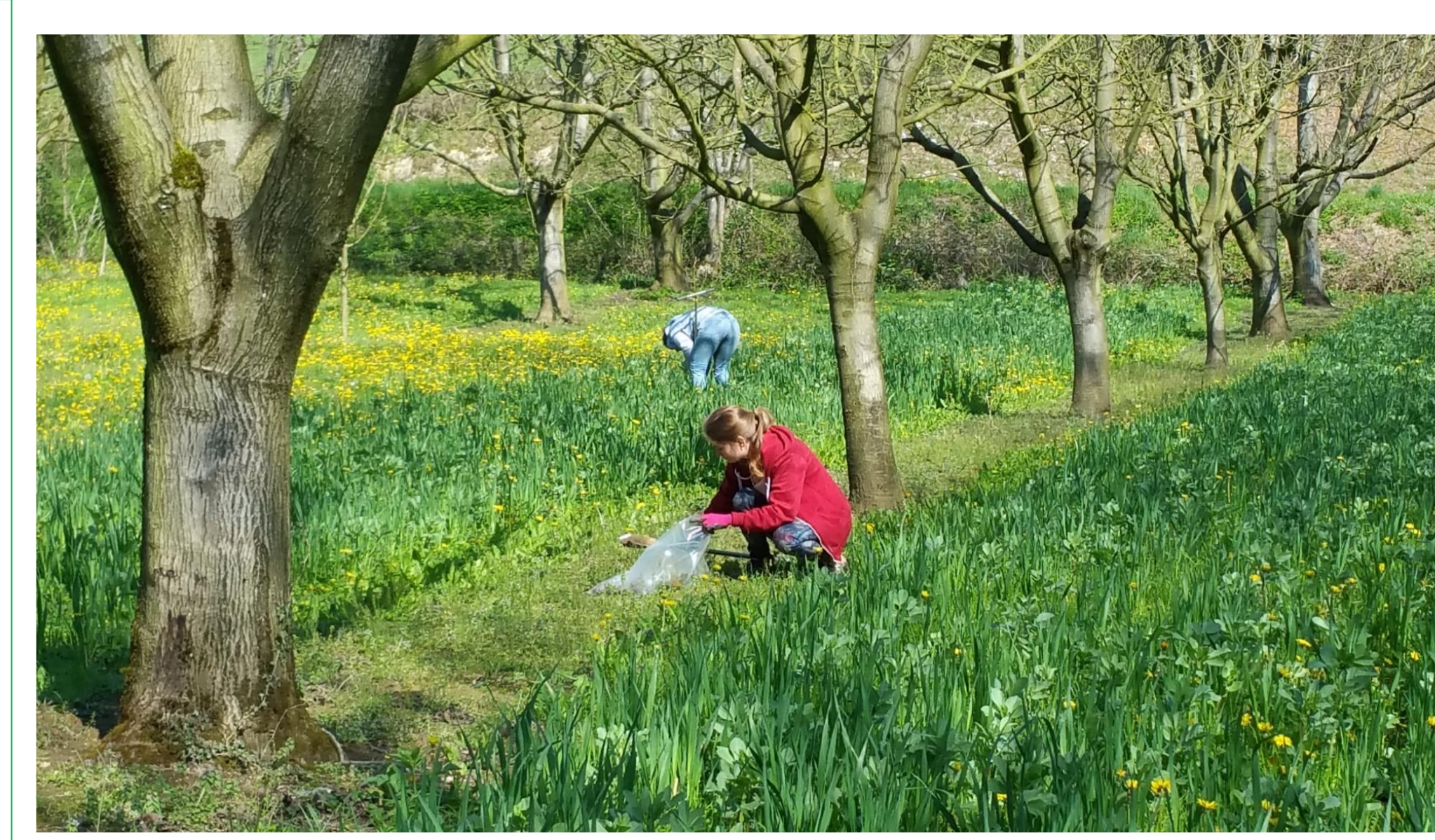
² Normandie Université, Fédération de Recherche Normandie Végétal FED 4277, France.

³ Chambre d'Agriculture de Dordogne, Place Marc Busson, 24200 Sarlat-la-Canéda, France.

Context : Agroforestry systems play a very important role in reducing wind speed, improving soil structure, increasing biodiversity and carbon sequestration [1]. One of the beneficial microbiota that have a symbiotic association with most of the plants is arbuscular mycorrhizal fungi (AMF) [2]. The diversity of AMF can be a critical factor in enhancing both the productivity and the diversity of plants in agroecosystems. However, very few studies have been carried out on the impact of mycorrhization on walnut trees with associated crops (e.g maize). The integration of a vegetal cover in intercrop in walnut plantations is an innovative practice, still little developed. Although cover crops are widely used in conservation agriculture or organic farming, there is little knowledge on the impact of cover crops on native mycorrhizal fungi. The aim of our study was to evaluate arbuscular mycorrhizal fungal community associated to walnut roots under agroforestry and agricultural systems.

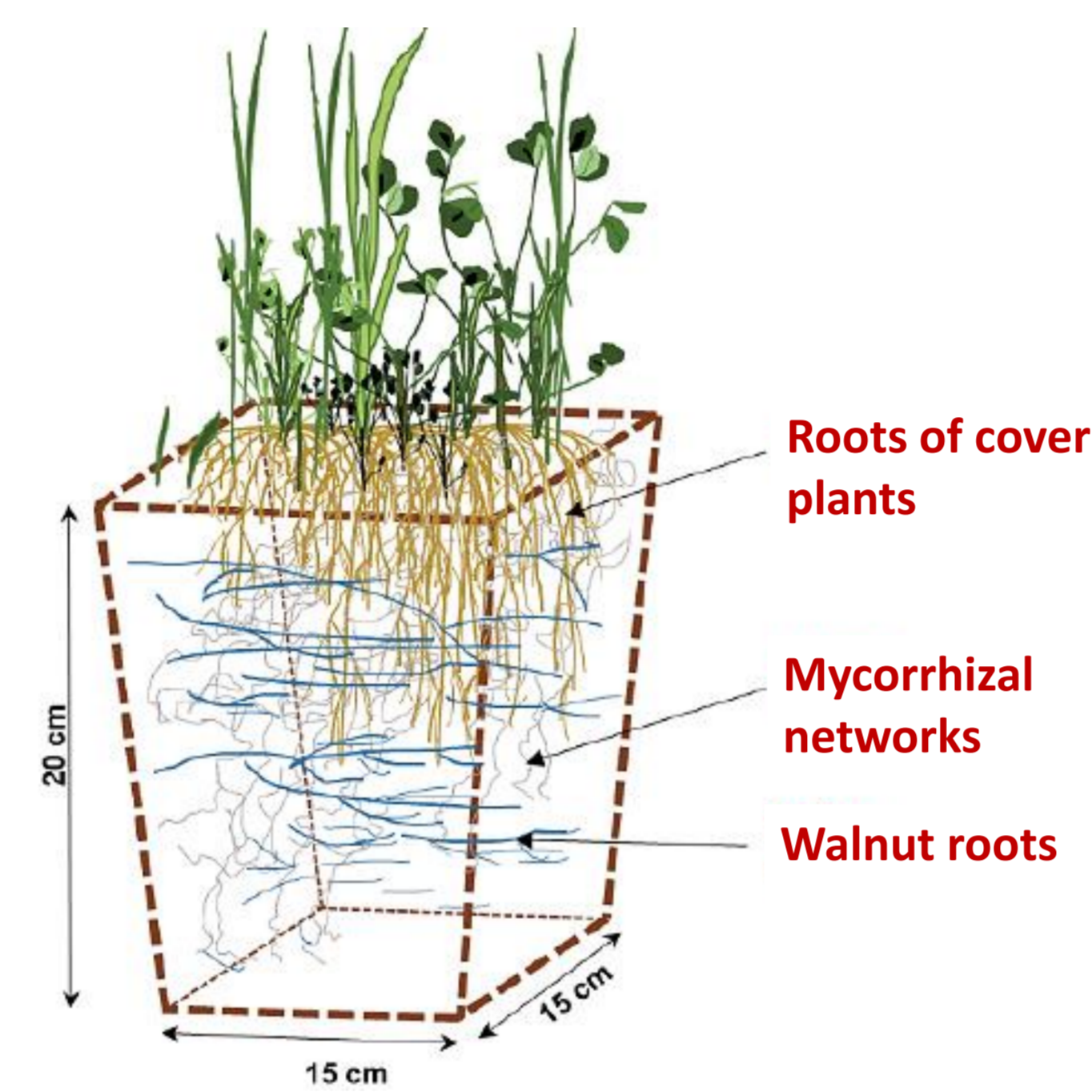


Walnut and maize in an Agroforestry plot



Walnut plantations with faba bean in an organic farming plot

Sampling and analyses of soil physicochemical and biological parameters



Roots of cover plants
Mycorrhizal networks
Walnut roots

In June 2017 and 2018, root and rhizosphere soil samples and technical itineraries were collected from the agroforestry plots in Dordogne and the experimental station of Cressy (South-western France). Five modalities (Walnut in Conventional with and without vegetal cover, Walnut in Organic farming with and without vegetal cover, Walnut and maize in Agroforestry) and soil physicochemical (Organic C, OM, N total, mineral N, pH, trace elements) and biological (DNA bacterial and fungal, mycorrhizal colonization, glomalin, ergosterol, enzyme activity) analyses were studied.

Morphological characterization of arbuscular mycorrhizal fungi in walnut roots



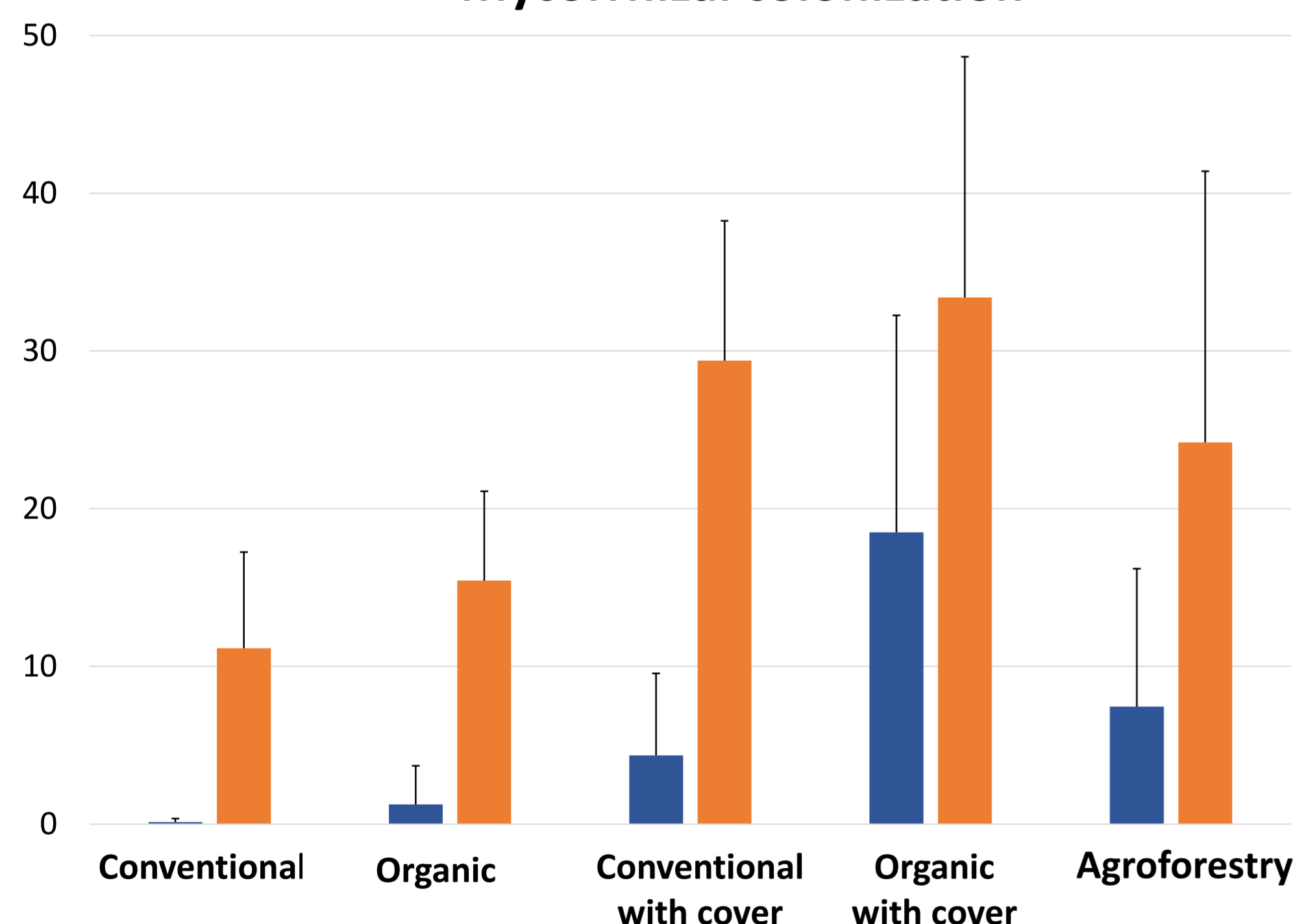
Walnut roots and rhizospheric soil aggregates



Walnut roots stained and mounted on slides

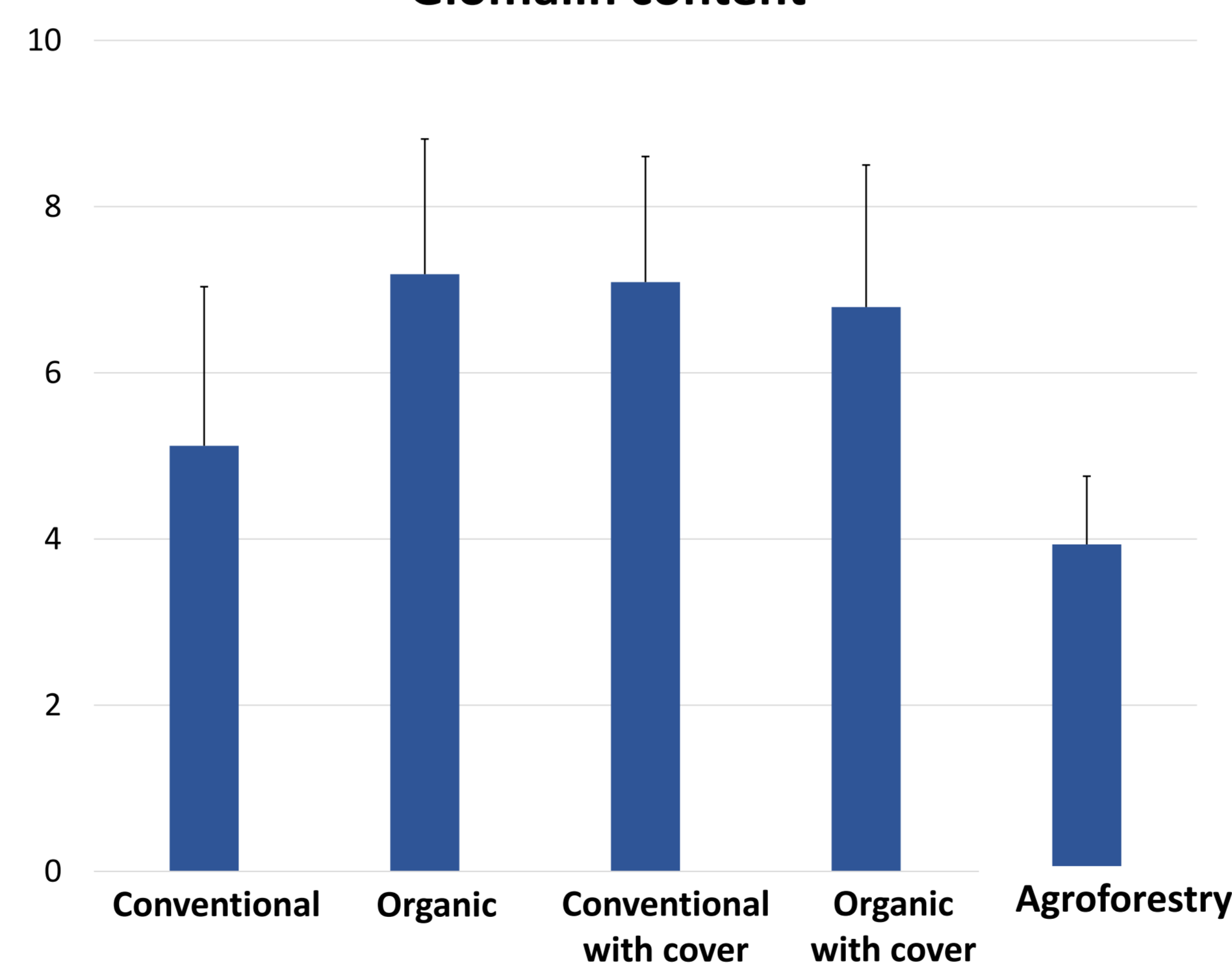
Native AM fungal community colonization in walnut plantations with faba bean

Mycorrhizal colonization

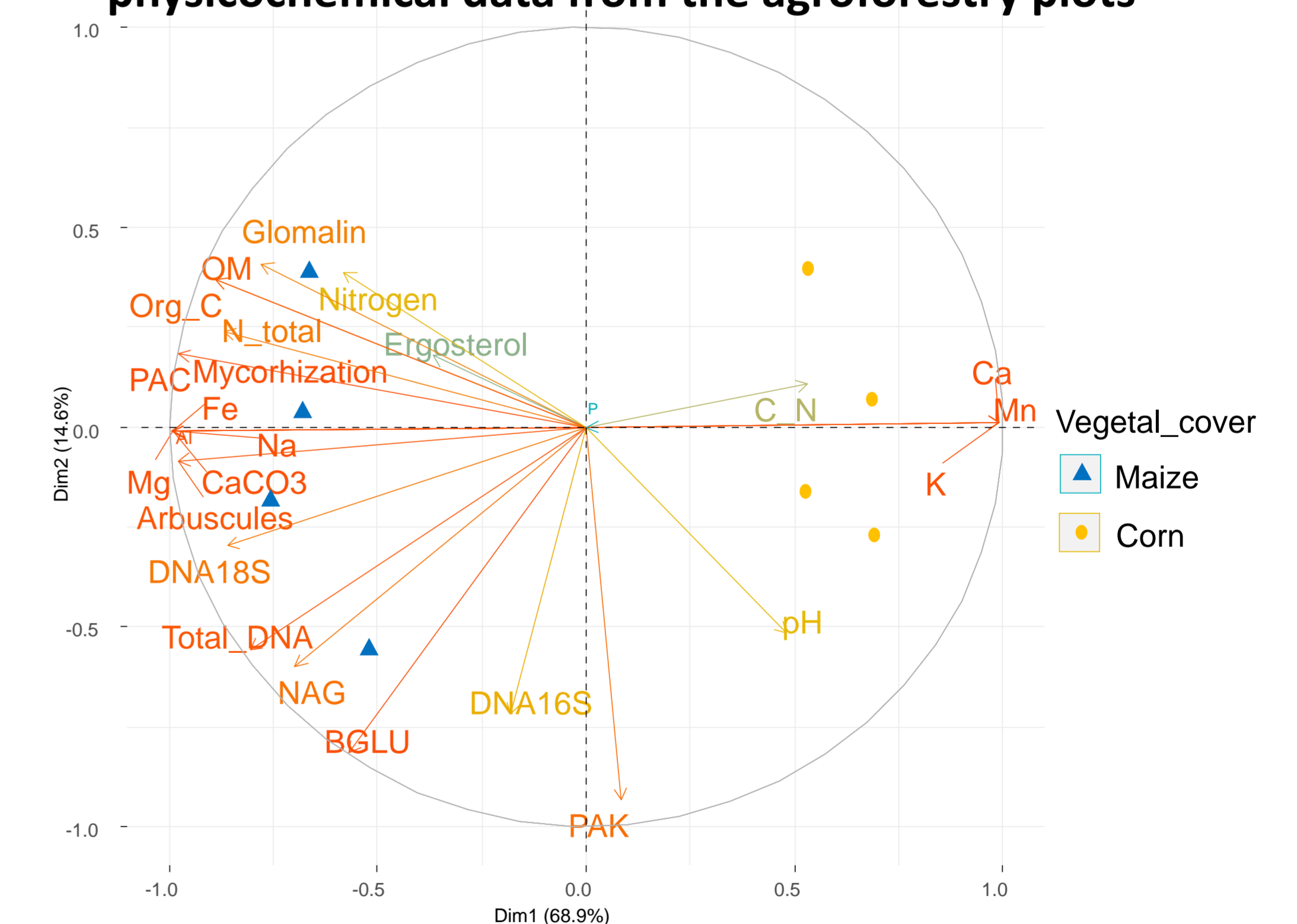


A%: Arbuscular density ; M%: Mycorrhizal intensity

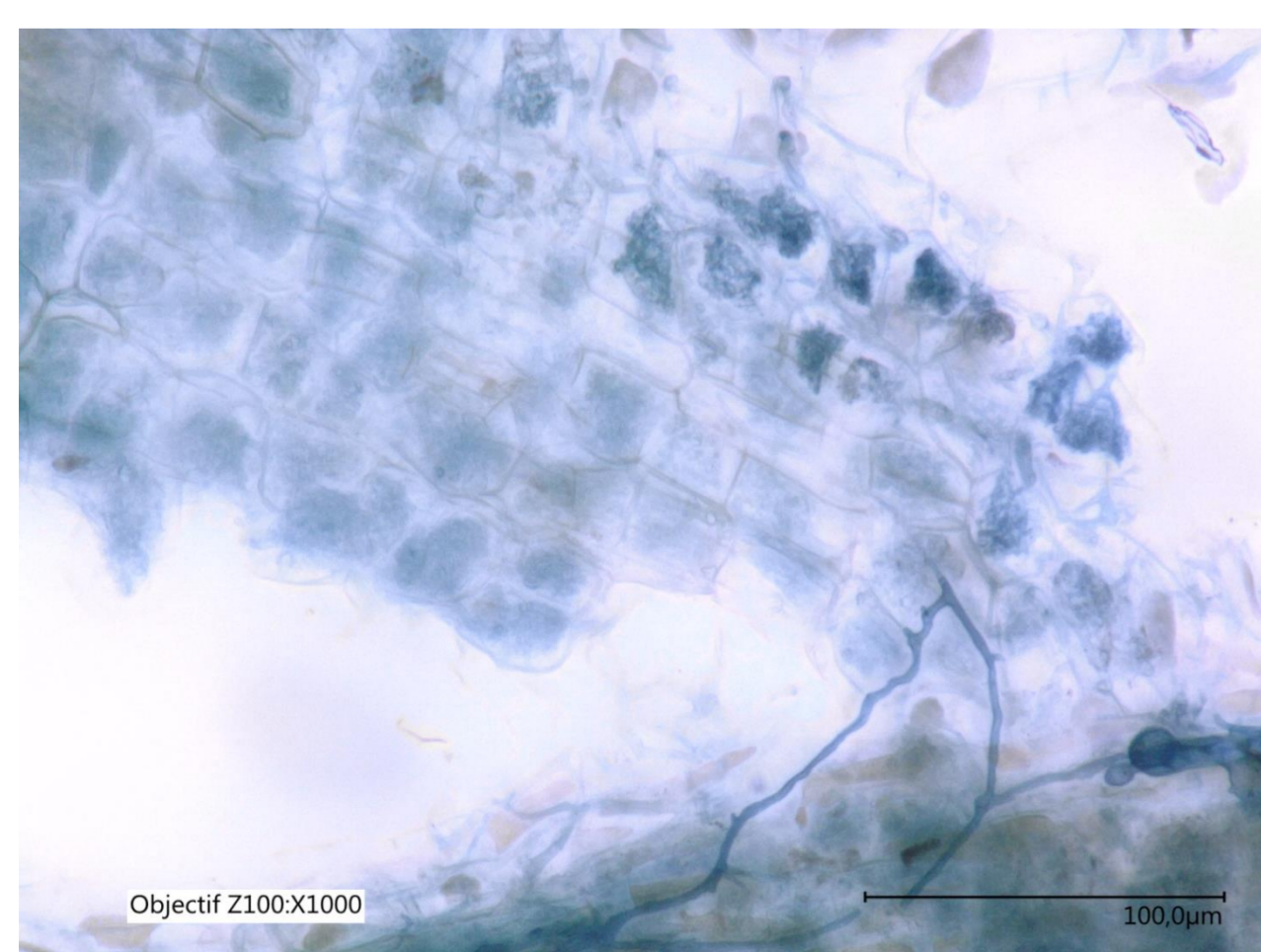
Glomalin content



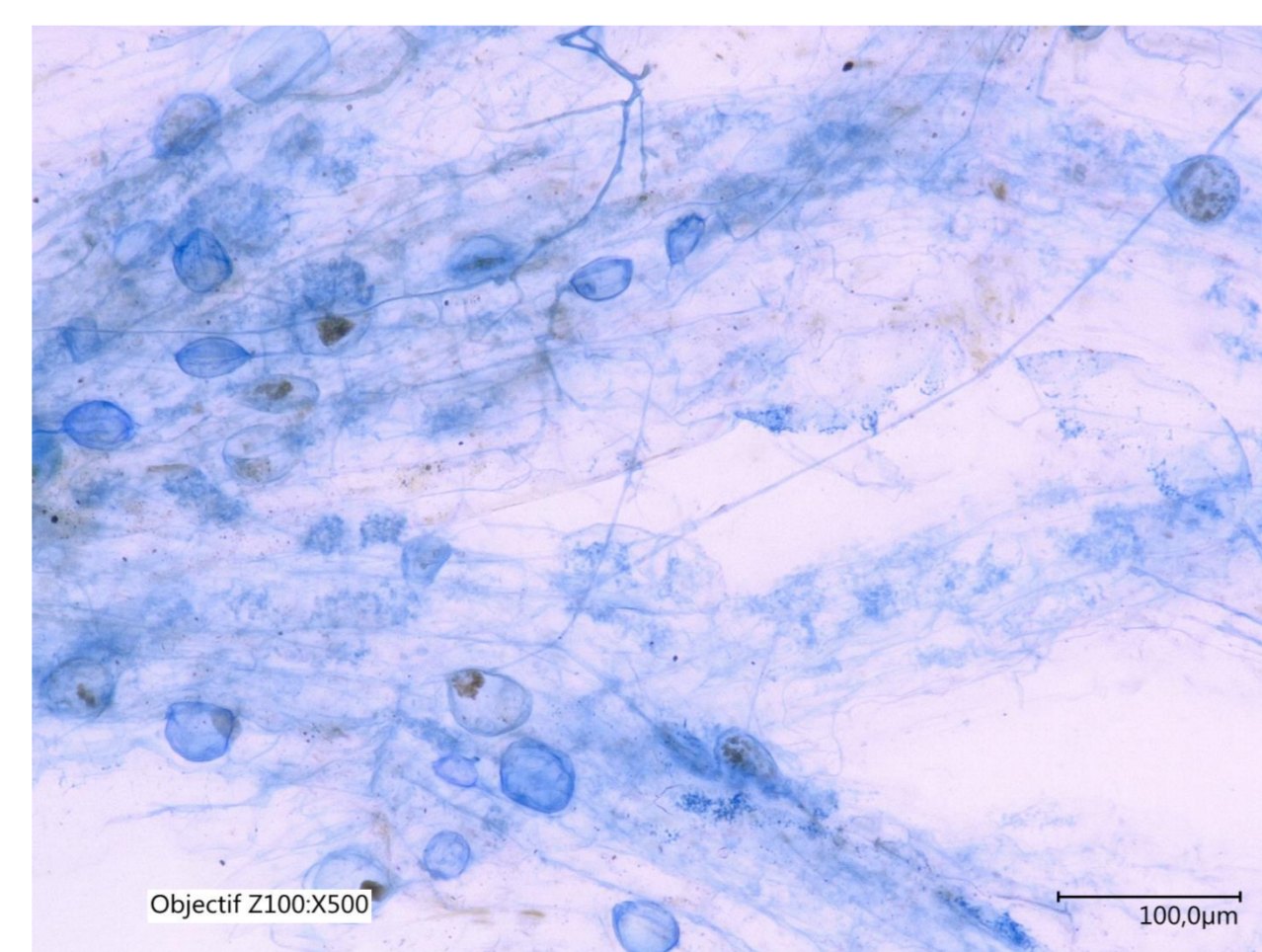
Principal Component Analysis (PCA) of the biological and physicochemical data from the agroforestry plots



Our results showed a higher mycorrhizal colonization in walnut trees in organic farming in comparison with those in conventional farming. In fact, the highest percentage of total AMF colonization was recorded for walnut trees in the presence of faba bean (M=33 % ; A=18%). However, mycorrhizal colonization observed in agroforestry plots accounted 24%. We also found significant differences between Conventional with and without cover in glomalin concentration. Multivariate analysis based on PCA revealed that ergosterol content, glomalin concentration and soil organic status were mainly correlated to mycorrhizal colonization and hence relevant to explain walnut trees mycorrhization. The use of faba bean showed the great role played by vegetal cover in the enhancement of mycorrhizal colonization of plants. The establishment of plots of mycorrhizal communities on walnuts with intercrop maize culture would be a very beneficial model to study the transfer of arbuscular mycorrhizal fungi from walnut trees to maize.



Arbuscules and hyphae observed in a walnut root in organic farming



Vesicles and hyphae observed in a faba bean root in organic farming

References

- [1] Elevitch C.R., Mazaroli D.N., Ragone D. (2018) "Agroforestry Standards for Regenerative Agriculture," Sustainability 10, 9, 3337; doi:10.3390/su10093337
[2] Smith SE, Read DJ (2010) Mycorrhizal symbiosis. London: Academic Press, Access Online via Elsevier.