

Long term monitoring of arable alley cropping fields in Belgium

The mission of ILVO (www.ilvo.vlaanderen.be) consists in performing and coordinating policy supporting scientific research and associated public service in view of sustainable agriculture, fishery, and food in an economic, ecological and social perspective. The institute has four research units: Plant Sciences, Animal Sciences, Social Sciences, and Technology and Food Sciences. ILVO is coordinator of the Consortium Agroforestry Flanders and has a long term experience with on-farm monitoring of agroforestry impacts.

During recent decades, the implementation of agroforestry has been linked to a wide set of beneficial effects such as, amongst others, increased carbon storage, enhanced soil conditions and biodiversity, product diversification and the related resilience at farm level. To quantify and analyse some of these effects under North-West European conditions (and Belgium in particular), ILVO is conducting long term monitoring research on a set of six agroforestry fields located in Belgium. The focus thereby is on (arable) alley cropping fields, since these can efficiently be combined with the use of modern machinery, hence they show high potential for integration in modern conventional cropping systems.

General info on location

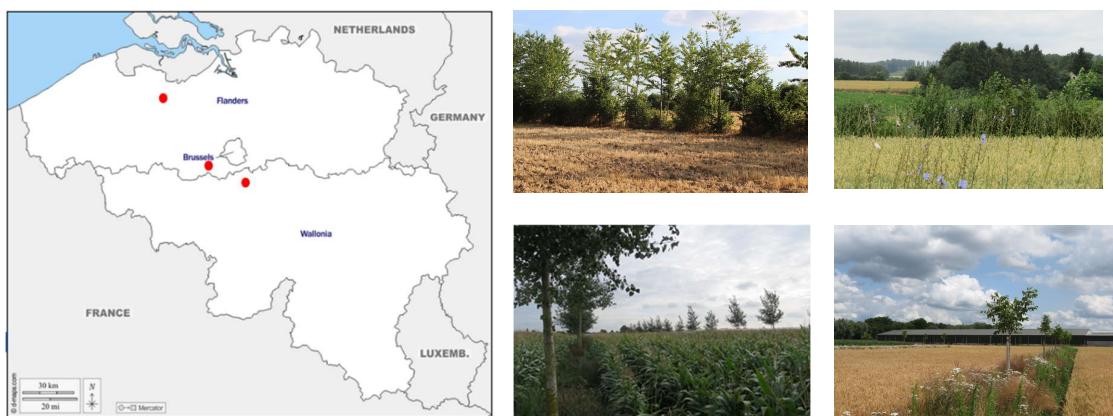


Figure 1: location and examples of the alley cropping fields included in the experimental set.

The fields are located in Lochristi (#3), Vollezele (#1) and Haut-Ittre (#2) (Figure 1). The tree species present comprise of *Populus x canadensis*, *Juglans regia* L., *Prunus avium* L. and *Sorbus torminalis* L. Crantz (Table 1). At Vollezele and Ittre, all available space between the trees was filled in with various shrub species (e.g. *Rosa canina* L., *Cornus* sp. and *Corylus avellana* L.). On each field a minimum of 2 tree rows was present. The distance between tree rows varied from 26 to 28 m, with the exception of the field in Vollezele where interrow distance was 54 m. Intra-row tree distance always equals approximately 8 m.

Table 1: characteristics of the experimental fields

Location	Date of plantation	Interrow distance (m)	Tree row width (m)	Tree species	Soil type
Vollezelle	03/2010	54	2	Prunus avium	Aba
Lochristi 1	03/2011	26	2	Populus sp.	Sdb, Zdb
Lochristi 2	03/2011	26	2	Prunus avium	Zdh
Haut-Ittre 2	11/2011	28	2	Juglans regia & Sorbus torminalis	Aba
Haut-Ittre 3	11/2011	28	2	Juglans regia & Sorbus torminalis	Aba, Lba
Lochristi 3	12/2012	26	2	Juglans regia	Zdh

Objectives and experimental setup

The measurements on these fields focus on tree main topics: *production, functional biodiversity and soil conditions*. These parameters are assessed as function of distance to the tree rows (Figure 2). The first measurements were conducted in 2013 on two fields (lochristi 1 and 2). From 2015 onwards, 4 additional fields were selected and included in the current set of experimental fields.

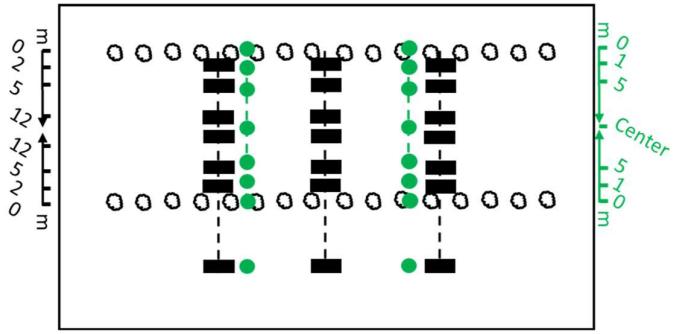


Figure 2: General experimental setup on the alley cropping fields (right). Black rectangles denote sampling locations for soil characterization and experimental harvests. Green dots denote sampling locations for monitoring of functional (arthropod) biodiversity.

Crop yield and quality: yield (ton DM) and quality of the arable crops cultivated on the fields is assessed. These include the main North-West European arable crops (maize, potato and winter cereals), as well as some less frequently cultivated crops but which show high potential for use in alley cropping systems. Growth and quality of the trees present is assessed approximately every tree years.



Soil conditions: several soil parameters are periodically assessed in the sampling plots used for the determination of crop production. These include SOC, a selection of soil nutrients (total N, P, K, Mg, Na, Ca), pH and gravimetric moisture content.

Functional biodiversity: Making use of pitfall traps, the effect of tree row presence on the activity-density and diversity of two types of macro-detritivorous arthropods (woodlice and millipedes) and two types of carnivorous arthropods (carabids and rove beetles) is assessed periodically as function of distance to the tree rows.



More info:

For more information or in case of any questions, please contact paul.pardon@ilvo.vlaanderen.be

Further reading:

This long term monitoring program is ongoing, former results and analysis of conducted measurements can be found amongst others in the following publications:

Janssens, A., 2021. How sustainable are temperate alley cropping systems? Masterthesis, Gent, 125pp. Available online: https://libstore.ugent.be/fulltxt/RUG01/003/012/822/RUG01-003012822_2021_0001_AC.pdf

Pardon, P., Reheul, D., Mertens, J., Reubens, B., De Frenne, Pieter, Smedt, P. de, Proesmans, W., van Vooren, L., Verheyen, K., 2019. Gradients in abundance and diversity of ground dwelling arthropods as a function of distance to tree rows in temperate arable agroforestry systems. Agric Ecosyst Environ 270-271, 114–128. doi:10.1016/j.agee.2018.10.017.

Pardon, P., Reubens, B., Mertens, J., Verheyen, K., De Frenne, P., De Smet, G., Van Waes, C., Reheul, D., 2018. Effects of temperate agroforestry on yield and quality of different arable intercrops. Agric. Syst. 166, 135–151.

Pardon, P., Reubens, B., Reheul, D., Mertens, J., De Frenne, P., Coussement, T., Janssens, P., Verheyen, K., 2017. Trees increase soil organic carbon and nutrient availability in temperate agroforestry systems. Agric. Ecosyst. Environ. 247, 98–111. doi:10.1016/j.agee.2017.06.018

Zwaenepoel, A., 2021. Multifunctionele performantie van jonge alley cropping agroforestrysystemen. Masterthesis, Gent, 73pp. Available online: https://libstore.ugent.be/fulltxt/RUG01/003/012/825/RUG01-003012825_2021_0001_AC.pdf