

Mixed cropping of winter wheat and winter peas: a natural nitrogen nutrition management for sustainable production of protein-rich seeds.

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Crops in association cereals - legumes are integrated into the ecologically intensive agriculture approaches. They allow a significant increase in protein yields of our crops while enabling to reduce the amounts of nitrogen fertilizers required for this production.

Since December 2012, the Crop Production Unit of Gembloux Agro-Bio Tech (ULg) and Soil Fertility Unit and Water Protection of the Walloon Agricultural Research Center are associated on a research project supported by the Walloon Region, which optimize the conduct of intercropping of winter peas and winter wheat. The objective of the study is to optimize the cultivation conditions of the wheat-peas association for a reliable production of dry matter at least equivalent to that produced by both pure crops on the same surface by improving the protein yield while reducing nitrogen fertilizer required for this production.

The experimentation

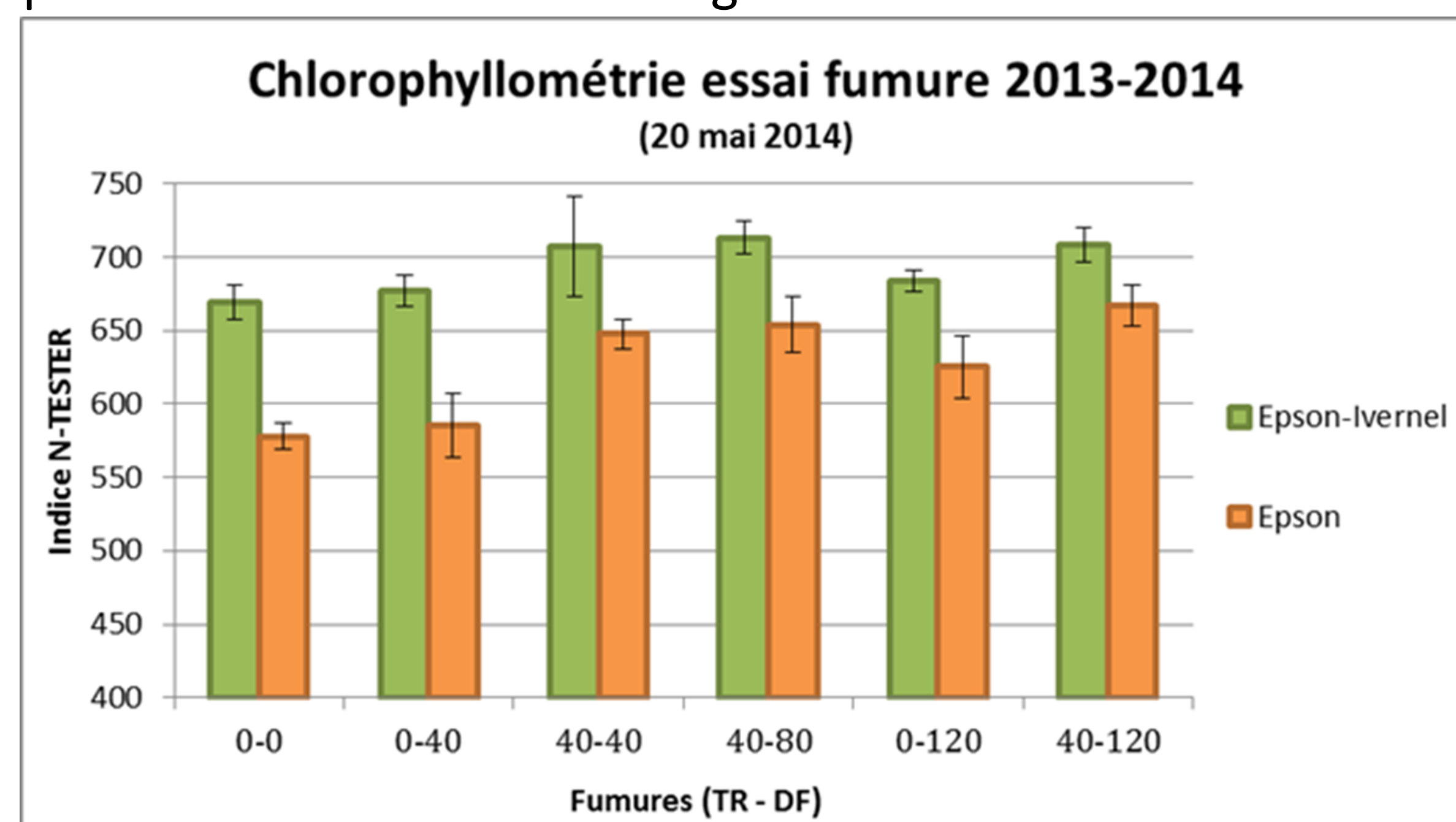


The experiments conducted since 2012 in the Gembloux region revolves around two research areas.

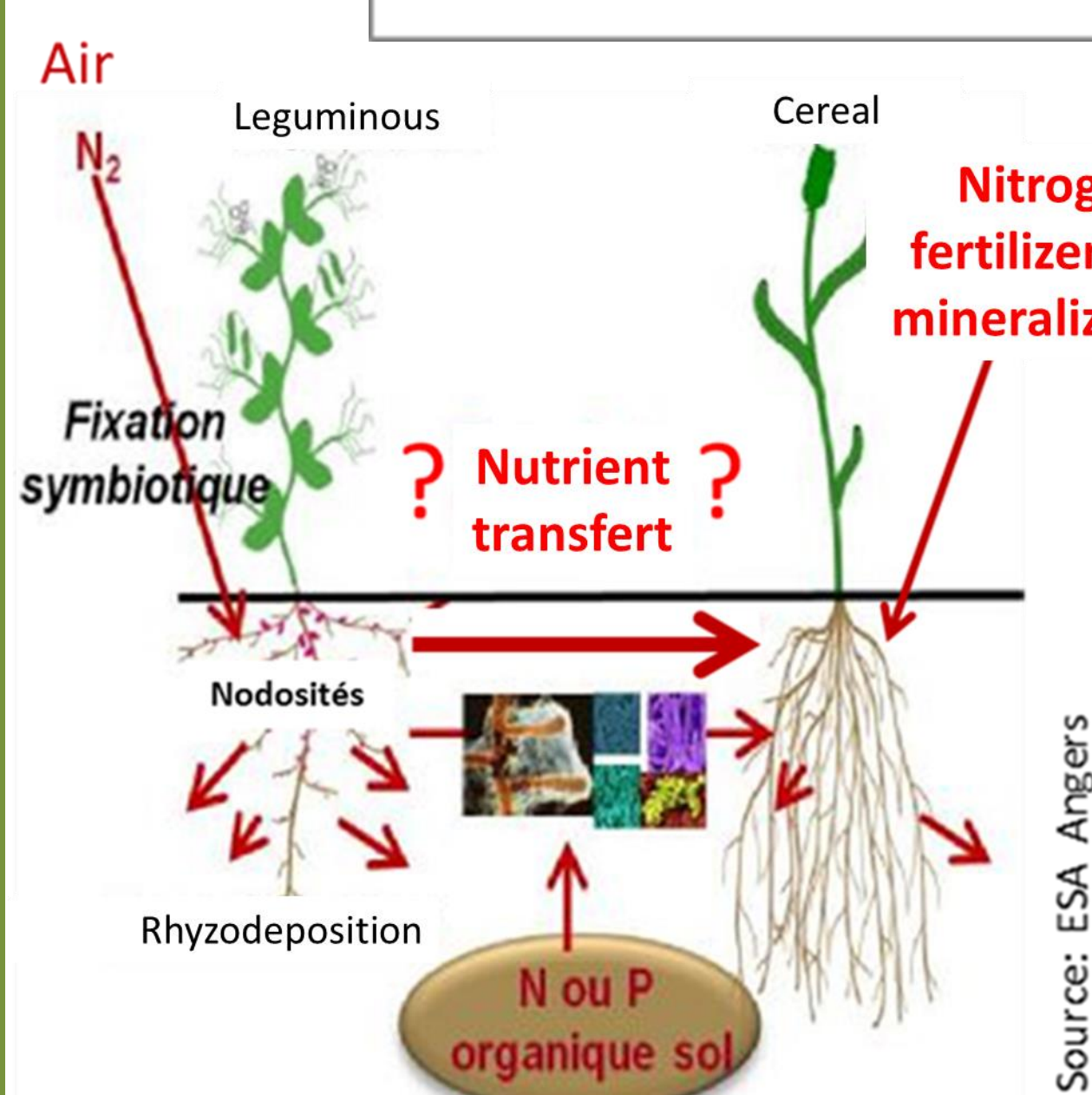
The first aims to characterize the impact of vegetation structure on the functioning of intercropping (seeding, varietal choice, ..) and the second is a better understanding of the nitrogen nutrition of Culture in association combining nitrogen supplies related to the legume nodules, mineralization of soil organic matter and nitrogen fertilizers. Particular attention is given to the operation of nodules as well as factors limiting or stopping the operation.

Natural nitrogen fertilisation

The results show a transfer of nitrogen from the leguminous to the cereal, especially this late in the vegetation. These transfers allow the observation of a state of nitrogen nutrition of higher wheat. The chlorophyllometry measures appear significant differences. The nitrogen content of wheat with other crops is higher than that of wheat in pure culture. There is also a greater difference when manure is low.



Graphic 1: Chlorophyllometry measures with N-tester. 20 may 2014 (wheat last leaf BBCH: 39)

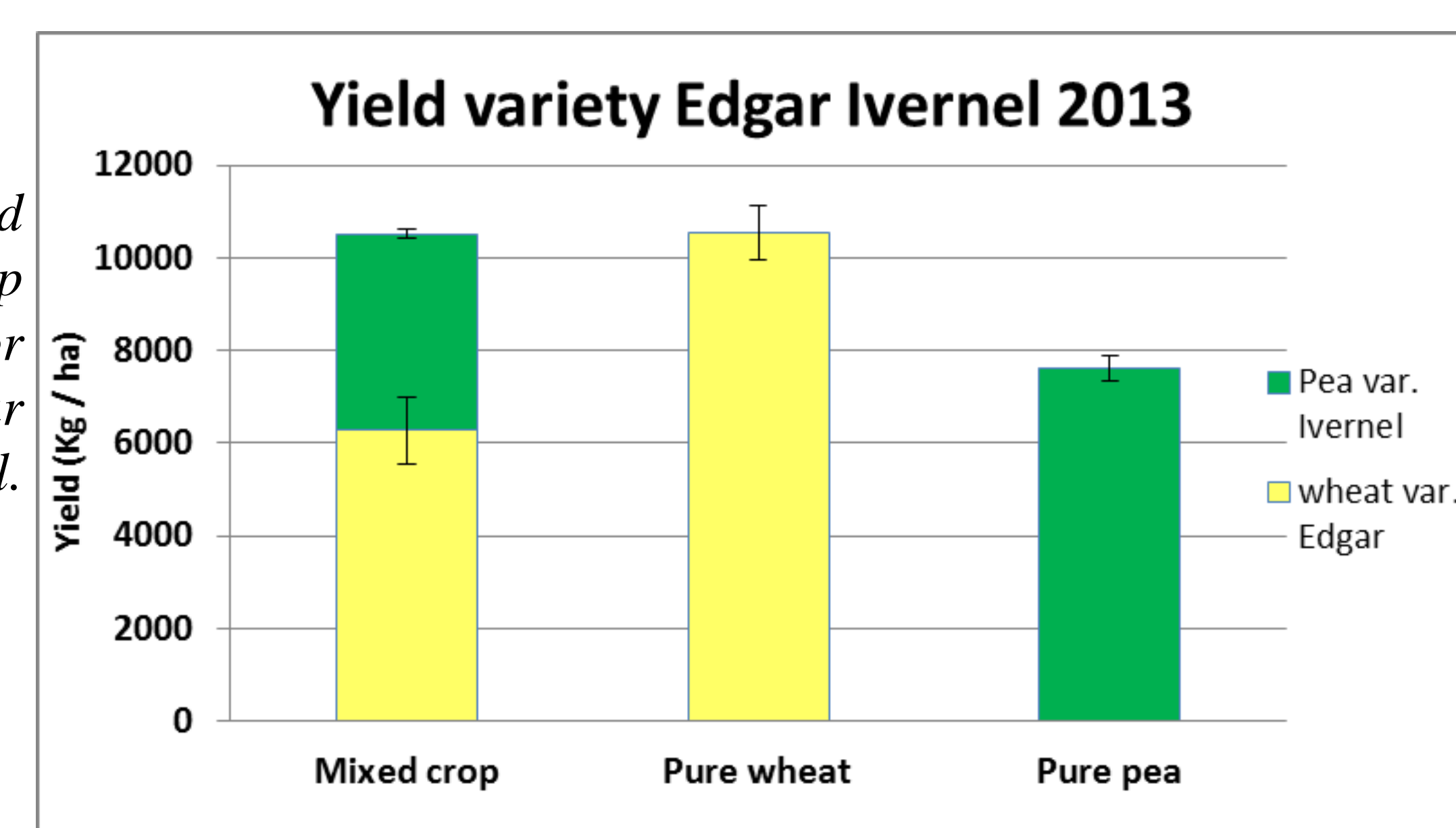


Source: ESA Angers

Quality harvest

Thanks to the association with the leguminous, the wheat harvest is optimized both in quantity and quality. The association can observe a synergy resulting in a higher dry matter production. Also thanks to this transfer of nitrogen between the two species, a higher quality of wheat grain is observed. This quality is superior to that obtained with synthetic fertilizers through more suitable nutrition with continuous transfer during the filling period of the grain.

Graphic 2: Yield result of mixed crop and pure crop for the variety Edgar Ivernel. 13/08/2013.



$$LER = LER_{pea} + LER_{wheat} = \frac{\text{Mixed pea yield}}{\text{Pure pea yield}} + \frac{\text{Mixed wheat yield}}{\text{Pure wheat yield}}$$

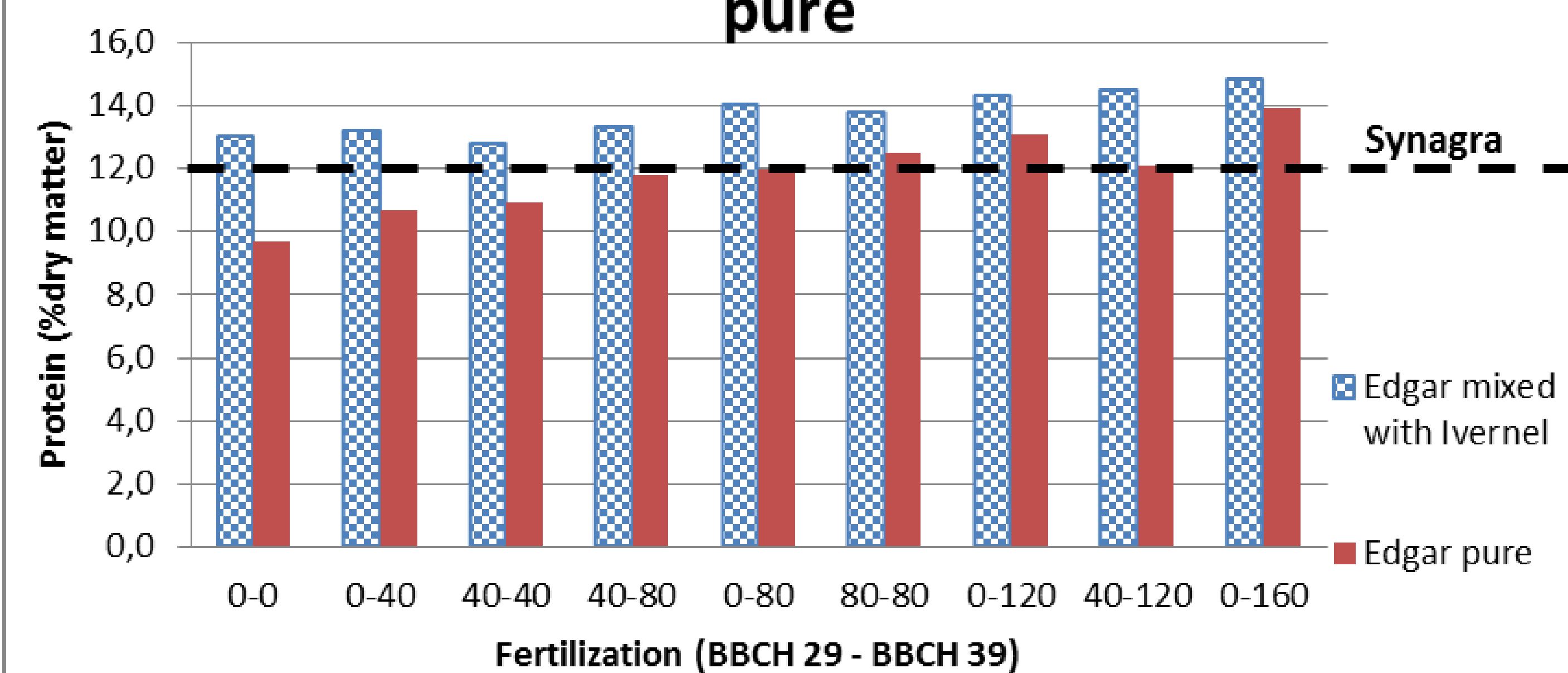
LER yield 2013

Sy Epsion Ivernel	1,43
Sy Epsion Spencer	0,85
Edgar Ivernel	1,15
Edgar Spencer	1,04
Mean	1,12

Tab 1: Land Equivalent index. The LER indicates the efficiency of mixed crop to use more or less environmental resources compared to pure cultures.

If index is more than 1 the mixedcrop is more efficient and inversely.

Wheat grain protein rate: Edgar mixed and pure



Graphic 3: Wheat grain protein rate for the variety Edgar. Synagra is the norm for baking quality (12 %). 13/08/2013.