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► To cite this version:

Laurent Bedoussac, Etienne-Pascal Journet, Henrik Hauggaard - Nielsen, Christophe Naudin, Guenaelle Corre - Hellou, et al.. Intercropping cereal with grain legume, an application of ecological principles to improve overall productivity and quality. 13. Congress of European Society for Agronomy, Aug 2014, Debrecen, Hungary. , 2014. hal-02796061

HAL Id: hal-02796061

<https://hal.inrae.fr/hal-02796061>

Submitted on 5 Jun 2020

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INTERCROPPING CEREAL WITH GRAIN LEGUME, AN APPLICATION OF ECOLOGICAL PRINCIPLES TO IMPROVE OVERALL PRODUCTIVITY AND QUALITY



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CONTEXTE

- In organic farming N availability is often limiting → yield depressions and lower protein concentrations
- Weeds, diseases and pests are often regarded as determinant factors → yields losses and lower product quality
- Intercropping (IC) is the simultaneous growth of two or more species in the same field for a significant period → an application of ecological principles known to use available abiotic resources more efficiently than the corresponding sole crops particularly in low-input systems due to functional complementarity within species



Hard wheat-Pea

OBJECTIVES

- Evaluate the potential advantages of cereal-legume intercrops for grain yield, grain protein concentration and weed control
- Analyze the functioning of cereal-grain legume intercrops to further propose optimized intercropped systems.

MATERIALS AND METHODS

- 48 organic experiments from 2001 to 2010 in experimental and farm contexts
- 3 pedoclimatic situations : France (south and west) and Denmark.
- Spring and Winter crops : barley ; soft and hard wheat intercropped with pea or faba bean
- Large range of practices : with or without organic N fertilization ; sowing species within row or in separate rows ; considering different sowing proportions and cultivars

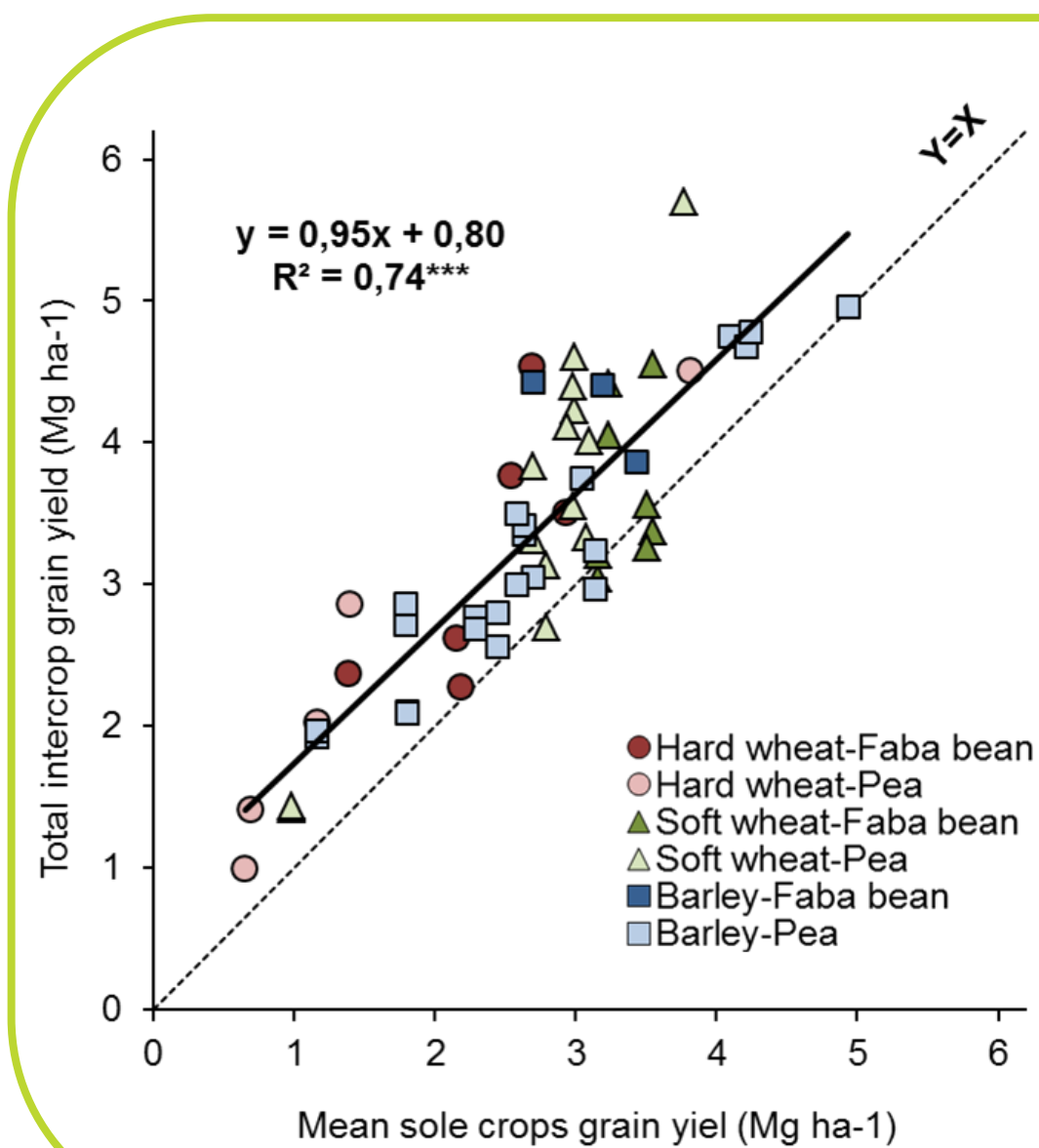


Experimental context

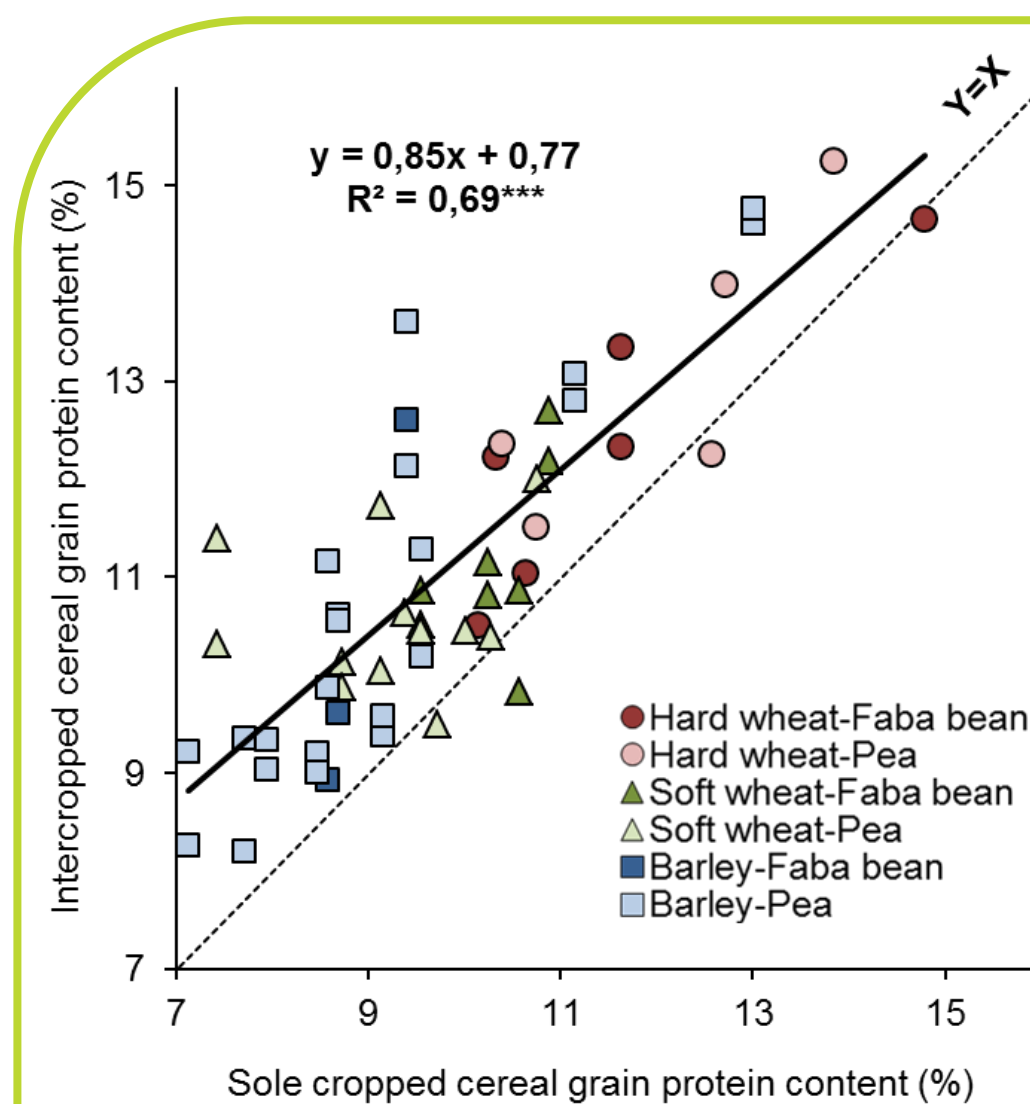


Farm context

RESULTS AND DISCUSSION

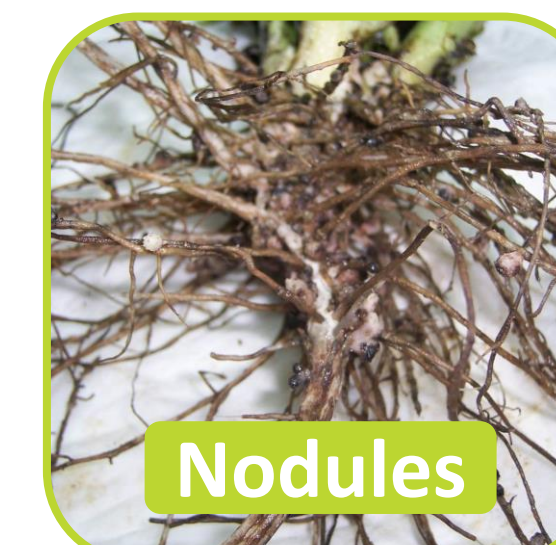


- Total intercrop grain yield was almost always higher than that of the mean sole crops (3.3 vs. 2.7 Mg ha⁻¹)
- Proportion of cereal > 50% → Cereal more competitive
- IC more efficient than sole crops without N fertilization or when N was applied late

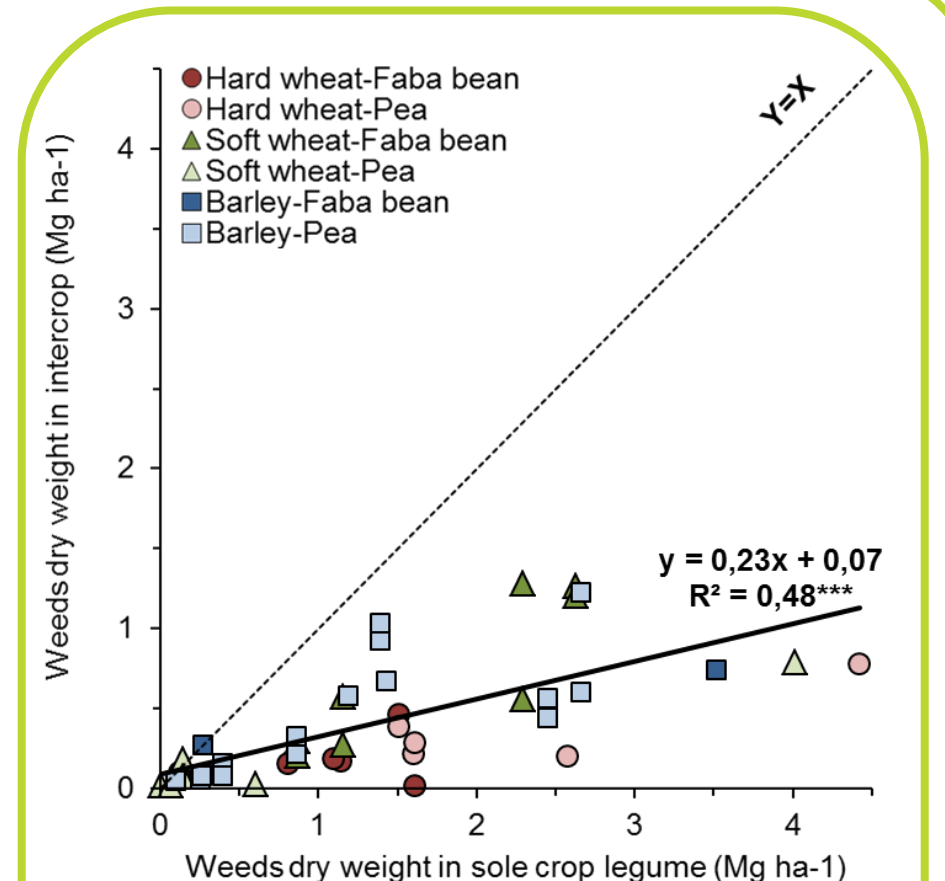


→ More N available per plant, per tiller and per grain for IC cereal

- Cereal grain protein concentration higher in IC than in sole crop (11.1% vs. 9.8%)
- Due to : 1) lower cereal grain yield and 2) low use of soil N by the legume (75% of its N from air)



Nodules



- Less weeds in IC compared to the legume (0.40 vs. 1.38 Mg ha⁻¹)

CONCLUSIONS AND PERSPECTIVES

- Development of intercrops need the collaboration of all the actors in the value chain (farmers, collectors, breeders, agribusiness companies, technical institutions & researchers)
- Modelling multi-species cropping systems (e.g. using STICS model) could be helpful to optimize intercropping systems and determine varietal characteristics suited to mixtures



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ESA Congress 2014

25-29 August 2014,
Debrecen, Hungary

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