



HAL
open science

Is 'durum wheat - winter pea intercropping' efficient to improve the use of light and N resources in low-input farming?

Laurent Bedoussac, Eric Justes

► To cite this version:

Laurent Bedoussac, Eric Justes. Is 'durum wheat - winter pea intercropping' efficient to improve the use of light and N resources in low-input farming?. 9. congress of the European Society of Agronomy, Sep 2006, Varsovie, Poland. Polskie Towarzystwo Agronomiczne, Fragmenta Agronomica, 11, 2006, Book of proceedings. hal-02755156

HAL Id: hal-02755156

<https://hal.inrae.fr/hal-02755156v1>

Submitted on 20 Jun 2023

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.

Is 'durum wheat – winter pea intercropping' efficient to improve the use of light and N resources in low-input farming?

Laurent BEDOUSSAC and Eric JUSTES

INRA, UMR ARCHE, Auzeville, BP 52627, 31326 Castanet-Tolosan, France

E-mail: Laurent.Bedoussac@toulouse.inra.fr – Eric.Justes@toulouse.inra.fr



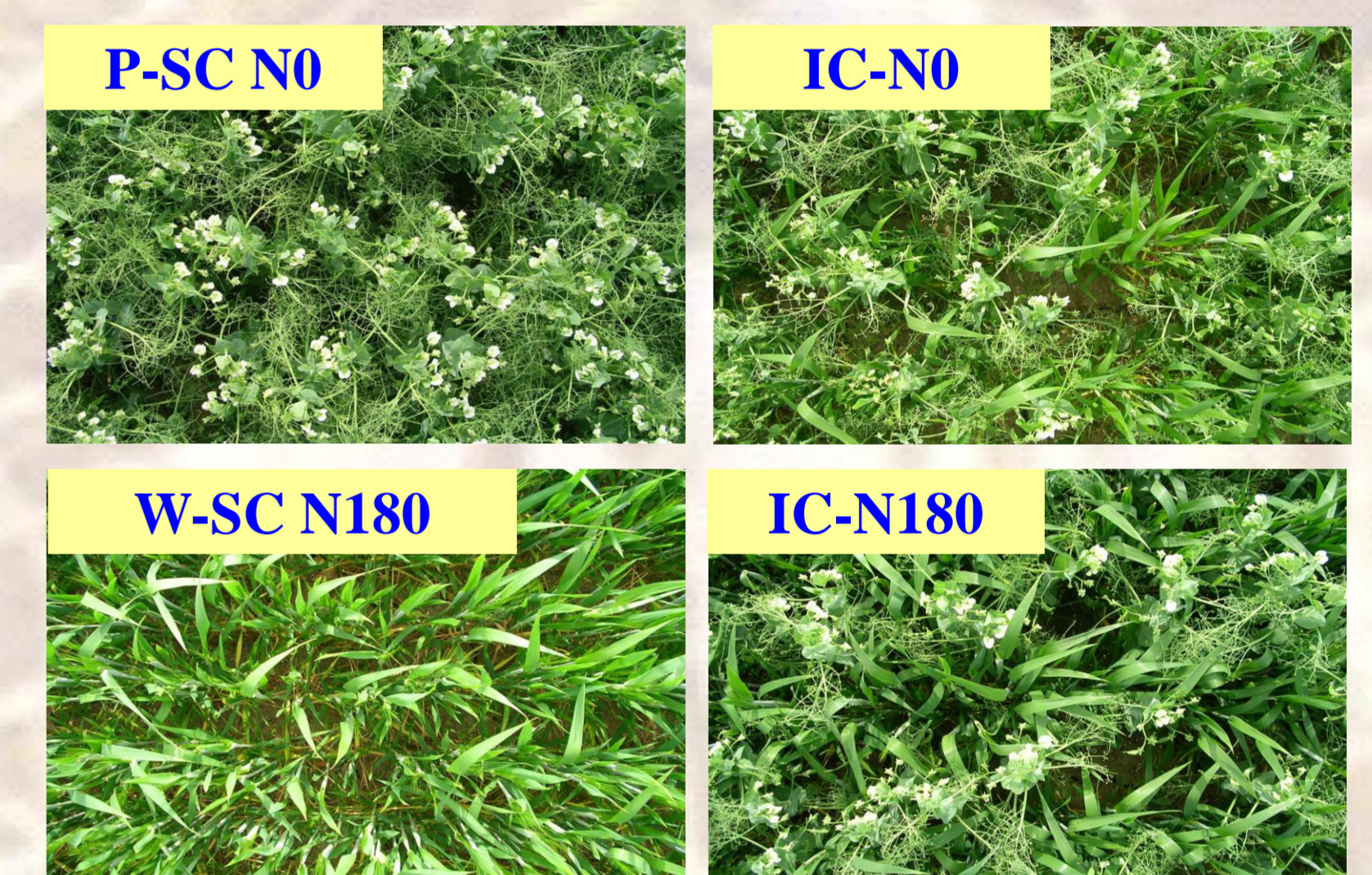
Background and objectives

- Intercropping (IC) is known as an agricultural practice which can improve the use of environmental resources (light, nutrients and water) that results in yield advantages and increased yield stability compared to sole cropping (SC) (e.g. Willey, 1979)
- Corre-Hellou et al. (2006) demonstrated that IC spring barley-pea advantages were mainly based on *i*) a better light use and *ii*) a deeper root growth of spring Barley vs. Pea
- More important soil N acquisition (e.g. Hauggaard-Nielsen and Jensen, 2001)
- Yield and protein content of barley in IC relatively higher than in SC (e.g. Hauggaard-Nielsen et al., 2003)
- No reference on winter wheat-grain legume IC was available, despite winter crops seems more adapted to conditions of southern Europe
- Aim of our study: Evaluate the assumption that IC can improve protein content of durum wheat in low-input system by focusing on:
 - i*) Understanding competition between durum wheat and winter pea for light and N during the early crop stages
 - ii*) Analysing the consequences on shoot growth and N acquisition during the crop cycle and grain protein content at harvest

Material and Methods

An experiment was carried out in Auzeville (SW France) in a clayed loamy soil. The two species were sown in row-intercropping at the same time on Nov. 8, 2005. The experiment was based on a randomized block design with 3 replicates

- Three main treatments were compared :
 - i*) Durum wheat (cv. Nefer) sown at normal density (280 seeds/m²): W-SC
 - ii*) Winter pea (cv. Lucy) sown at normal density (60 seeds/m²): P-SC
 - iii*) Durum wheat-winter pea IC, each specie sown at half of normal density: IC
- Three fertiliser-N sub-treatments were carried out on W-SC and IC :
 - i*) No fertilizer: N0 (also carried out for P-SC)
 - ii*) Low fertilization splitted into 2 applications of 50 kg N/ha: N100
 - iii*) Moderate fertilization in 3 applications 30, 100 and 50 kg N/ha: N180
- Measurements made :
 - i*) Fraction of photosynthetically active radiation (PAR) absorbed by the crop (FPARa)
 - ii*) Nitrogen status of SC and IC were evaluated by calculating the nitrogen nutrition index (NNI) and the grain protein concentration
 - iii*) Land Equivalent Ratio (LER), which is defined as the relative land area under SC that is required to produce the yields achieved in IC (e.g. Hauggaard-Nielsen and Jensen, 2001) was calculated at key crop stages



Results

- FPARa of IC was greater than for P-SC in early stages but was slightly lower than W-SC (Fig. 1). From 950 DD until wheat flowering, FPARa of IC became equal to P-SC and higher than W-SC
- FPARa of unfertilized IC was the same as the FPARa of the fully fertilized W-SC (Fig. 1)
- LER values of IC were higher than 1 (Tab. 1)
- Light and nutrients resources were used 8 to 23% more efficiently in IC than SC
- Partial LER (LERp) of wheat were always greater than pea and always higher than 0.5
- Wheat took advantage of IC by using available resources more efficiently than pea
- Grain Protein content (GPC) of durum wheat was significantly greater in IC (Tab. 2)
- GPC of winter pea was the same in SC and IC and increased with fertilizer-N increasing

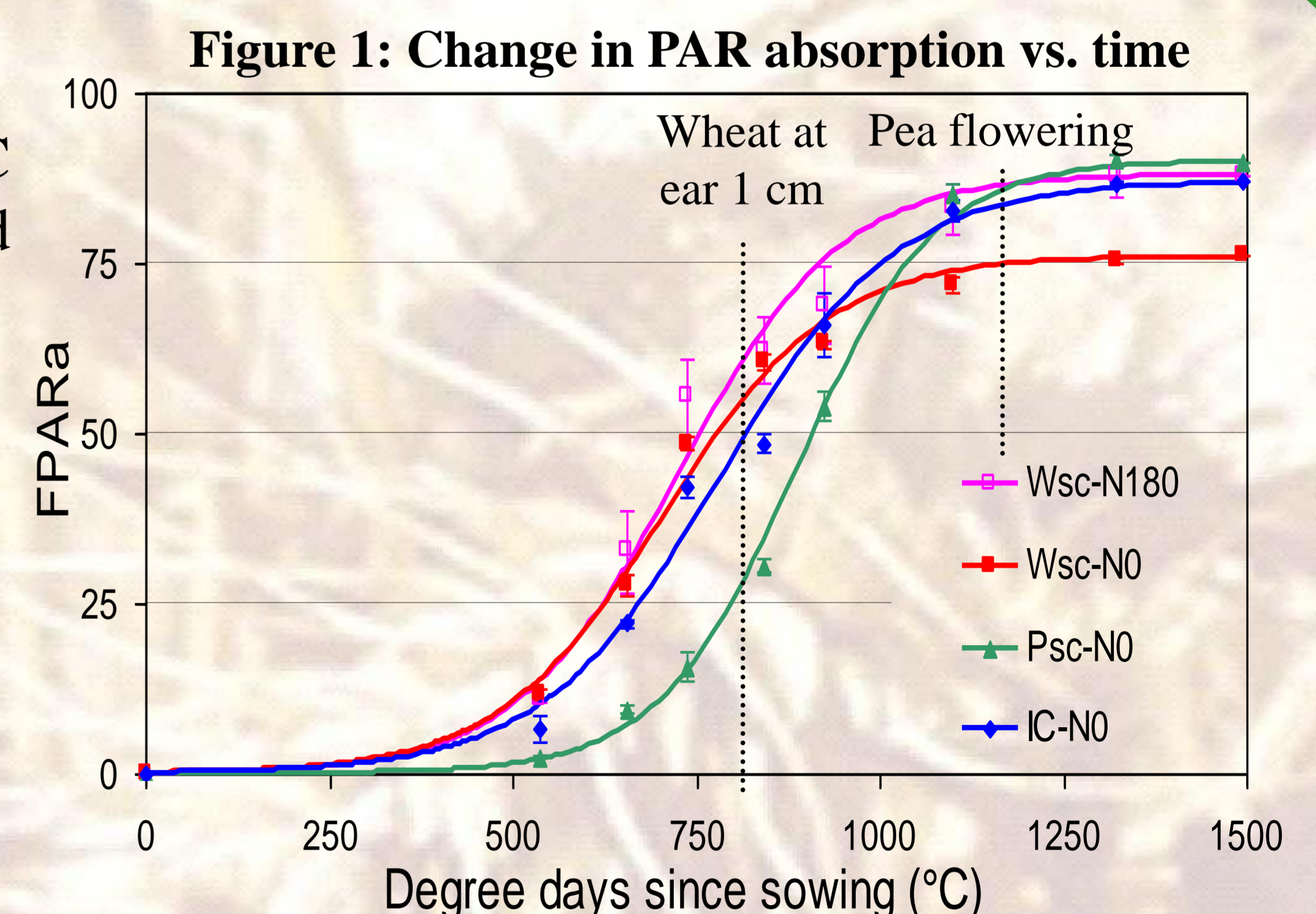


Table 1: Land Equivalent Ratio at harvest

	LERp P	LERp W	LERtotal
N0	0,51 (0,09)	0,72 (0,10)	1,23 (0,18)
N100	0,59 (0,03)	0,60 (0,10)	1,19 (0,11)
N180	0,38 (0,00)	0,70 (0,13)	1,08 (0,13)

Table 2: Grain Protein Concentration (%)

	W-SC	W-IC	P-SC	P-IC
N0	8.1 (0.1)	9.5 (0.2)	18.4 (0.3)	17.6 (0.6)
N100	13.1 (0.2)	14.7 (0.4)	20.6 (0.7)	20.6 (0.7)
N180	12.8 (0.4)	13.7 (0.6)	22.4 (0.5)	22.4 (0.5)

Conclusions

- The 'durum wheat - winter pea intercropping' seems well adapted to the conditions of Southern France because it allowed *i*) a better use of light and nitrogen resources during winter and early spring and *ii*) a higher grain protein concentration of durum wheat at harvest
- The PAR absorption of intercrop and the wheat grain protein concentration was greater in IC, in particular for the unfertilized treatment, confirming the interest of intercropping in low-input systems