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

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SUMMARY

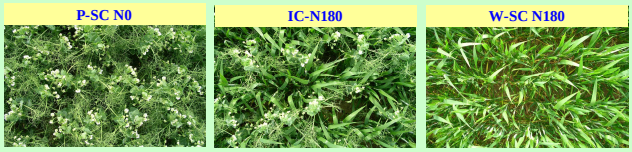
- **Nitrogen acquisition** is often a major concern, particularly in low input systems where mineral **N is a limited resource**.
- We hypothesis that **Durum wheat – Winter pea intercropping (IC) is more efficient than the sole crops (SC) for their ability to improve the use of N resources**.
- Field experiment were carried out in SW France in 2005-2006 with three fertiliser-N supply : **no fertilizer (N0) ; 100 kg N/ha-1 (N100) and 180 kg N/ha-1 (N180)**
  - ***i)*** Values of **LER where significantly higher than 1** for all N-treatments particularly for N0 and N100
  - ***ii)*** For all treatments, **N uptake** of Durum wheat was greater than in IC but always lower than the whole IC cover
  - ***iii)*** **Proportion of Nitrogen Derived from symbiotic fixation was higher in IC** than in SC
  - ***iv)*** **Residual soil inorganic amount** at harvest was higher in IC compared to wheat SC but lower than pea SC

CONCLUSIONS

- The '**Durum wheat - Winter pea intercropping**' seems well adapted to the conditions of Southern France because it allowed
  - ***i)*** **a better use of N resources (and light) during early spring growing season due to the complementarities of the 2 species**
  - ***ii)*** **a higher grain protein concentration of durum wheat at harvest**
- IC advantages were greater for the unfertilized treatment **confirming the interest of intercropping in low-input farming**

MATERIAL AND METHODS

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



- **Three main treatments were compared:** ***i)*** **W-SC:** Durum wheat (cv. Nefer sown at 280 seeds/m²) ; ***ii)*** **P-SC:** Winter pea (cv. Lucy - 60 seeds/m²) ; ***iii)*** **IC:** Durum wheat-winter pea IC, **each specie sown at half of SC density**
- **Three fertiliser-N sub-treatments were carried out:** ***i)*** **N0:** No fertilizer ; ***ii)*** **N100:** 100 kg N/ha ; ***iii)*** **N180:** 180 kg N/ha
- **Measurements made:** ***i)*** Land Equivalent Ratio (**LER**), defined as the relative land area under SC required to produce the yields achieved in IC and decomposed in partial LER (**LERp**) corresponding to each specie (e.g. Hauggaard-Nielsen and Jensen, 2001) ; ***ii)*** Nitrogen acquisition at harvest (**N uptake**) ; ***iii)*** Proportion of Nitrogen derived from air (**% Ndfa**) estimated by the isotopic dilution method ; ***iv)*** Soil inorganic content at harvest (**Nmin**) on 0-120 cm layer

RESULTS

Land Equivalent Ratio

N	LERp P	LERp W	LER
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)

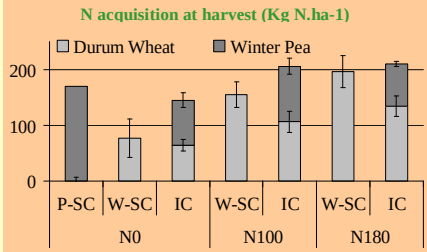
*: In comparison to N0 treatment

LER values were always higher than **1**

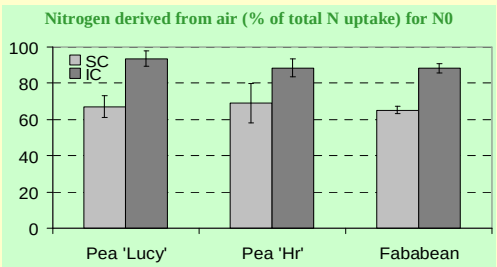
LERp W were always greater than LERp of pea and always higher than **0.5**

→ **Environmental resources were used 8 to 23% more efficiently in IC particularly in low-input**

→ **Wheat took advantage of IC by using resources more efficiently than pea**

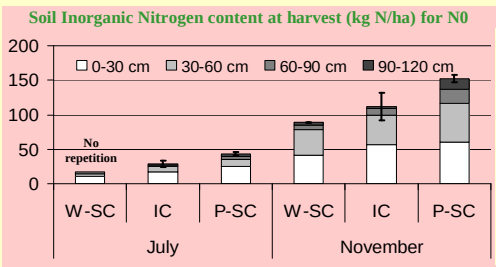


N uptake of W was higher in SC but lower than the whole N acquisition of IC



% Ndfa was higher in IC than in SC for all grain legumes evaluated

→ **Complementarity use of soil N and symbiotic N2 fixation sources in IC**



Soil inorganic content at harvest was higher in IC compared to W-SC but lower than P-SC

→ **Lower risk of lixiviation in IC versus P-SC**

→ **Greater N supply for next crop after IC than after W-SC**

Durum Wheat - Winter Pea intercropping is clearly more adapted to low nitrogen input systems

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