The efficiency of durum wheat and winter pea intercropping to increase wheat grain protein content depends on nitrogen availability and wheat cultivar

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Aim of our study: The ‘Durum wheat - Winter pea intercrocpping’ seems well adapted to the Southern France conditions because it allows:

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
iii) IC advantages were greater for the unfertilized treatment confirming the interest of intercropping in low-input farming

Objectives:

Three main treatments were compared:

i) W-SC: Durum wheat (sown at 280 seeds/m²);
ii) P-SC: Winter pea (cv. Lucy sown at 60 seeds/m²);
iii) IC: Durum wheat-winter pea IC, each species sown at half of SC density

Four wheat cultivars of different height:

i) Ac: Acalou (89 cm);
ii) Nf: Nefer (98 cm);
iii) Nd: Neodur (98 cm) and iv) Oj: Orjaune (116 cm)

Three fertiliser-N sub-treatments:

i) N0: No fertilizer;
ii) N60: 60 kg N.ha⁻¹ (at FLV ‘flag leaf visible’ to increase wheat GPC ) and
iii) N80: 80 kg N.ha⁻¹ (at ‘ear 1cm’ to increase wheat yield)

Measurements made:

i) Wheat grain protein concentration (GPC);
ii) Grain yield and iii) 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.

Materials and Methods

An experiment was carried out in Auzeville (SW France) in 2006-2007 on a clay loamy soil. The two species were sown on November 2006 the 9th in row-intercropping.

The experiment was based on a split-split-plot design with 3 replicates.

Conclusions

Aim of our study: Evaluate the assumption that Durum wheat – Winter pea intercropping (IC) is more efficient than sole crops (SC) by:

i) Understanding competition between durum wheat and winter pea for different wheat cultivars
ii) Analysing the consequences of N availability on the performance of IC (grain protein, yield and species proportion)

Results

- Wheat Grain Protein in IC vs SC
  - IC GPC was 13% higher than in SC
  - Greatest GPC for N60 applied at FLV
  - Ac and Nd have greater GPC in SC & IC
  - IC reduced the gap in cultivars GPC

- Wheat Yield in IC vs SC
  - IC Yield was about 68% of the SC Yield
  - IC Yield greatest with N60
  - SC Yield greatest with N80
  - Oj/Nd IC yield 20% greater than Nf/Ac

- Land Equivalent Ratio
  - LER greater than 1 for N0 and N60
  - Wheat LERp always higher than 0,5
  - Nd & Oj Wheat LERp greater than Nf & Ac
  - Pea LERp strongly reduced with N supply
  - Pea LERp lower for Nd and Oj
  
  → IC more efficient than SC in N0 and N60
  → Wheat took more advantage of N than pea
  → Complementary use of N resources
  → Pea yield is more reduced with tall cultivars

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iii) IC advantages were greater for the unfertilized treatment confirming the interest of intercropping in low-input farming

Choices in N supply and wheat cultivar depend on the target of the intercrop. Two directions are possible:

i) Increasing N availability and/or choosing a tall wheat cultivar that could increase wheat proportion
ii) Reducing N supply and/or choosing a short wheat cultivar that could increase wheat grain protein and pea proportion

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