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Agronomic performance and yield stability of pea-barley intercropping in European organic farming system.

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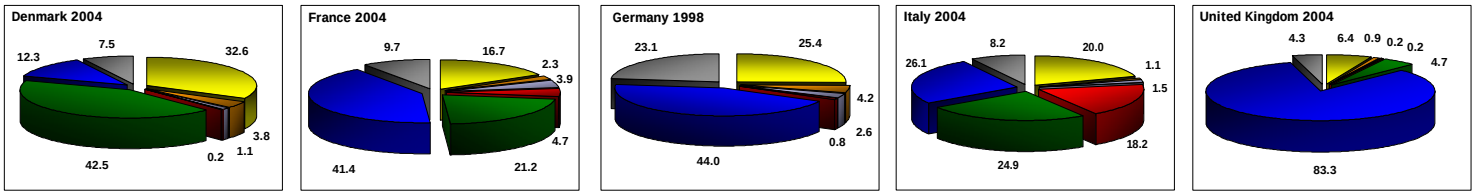
QLK5-2002-02352
www.intercrop.dk

One of the main objectives of the EU Project *INTERCROP* is to determine the agronomic performance of cereal-grain legume intercrops in different European agro-climatic conditions in terms of yield advantage and stability of intercrops compared to associated sole crops.

ORGANIC CROP AREA IN THE *INTERCROP*'S COUNTRIES

In all Countries-partners, grassland and fodder represent the predominant crops in the organic agriculture reaching 88% of total organic lands use in UK. Cereals sole crops are also well represented, particularly in Denmark and Germany. The range is between 6.4% (UK) and 32.6% (DK). Generally higher differentiation is in France and Italy due to large climatic diversification of environments.



Elaboration from EUROSTAT data

MATERIALS AND METHODS

Experimental sites:

DK (Tåstrup, 55°40'N, 12°18'E)
FR (Thorigné d'Anjou, 47°37'N, 0°39'W)
GER (Kassel, 51°25'N, 9°25'E)
IT (S. Marco Argentano 39°18'N, 21°12'E)
UK (Reading, 51º45'N,0º93'W).

Cropping seasons: 2003-2005 spring

Crops and densities:
Pea (*Pisum sativum L.)* cv. "Baccara" 90 plant m-2
Barley (*Hordeum vulgare L.)* cv. "Scarlett" 300 plant m-2

Layout:
Additive IC series (ADD): Pea 100% and barley 50% of sole crop (SC) densities
Replacement IC series (REP): Pea and barley 50% of SC densities

Experimental design:
Randomized block design with four replicate

Climatic conditions (2003-2005)

Different climatic conditions between sites heavily influenced the crop cycle.
IC concluded the cycle with maturity of barley, ranging from 96 (IT) and 134 (UK) days after sowing. Flowering of pea was generally 1 week earlier than heading of barley. Harvest occurred at the end of June in IT and at the beginning of August in DK and GER.

	Cropping season				
	March	April	May	June	July
T min(°C)					
DK	- 0.6	3.3	8.3	11.3	13.7
UK	2.1	3.3	6.7	10.2	11.5
FR	2.2	4.5	7.9	12.1	12.7
GER	0.1	3.4	7.2	10.8	11.8
IT	6.0	8.8	13.0	17.9	21.0
T max (°C)					
DK	5.8	11.6	16.0	19.1	21.4
UK	12.6	15.8	17.9	22.5	23.2
FR	14.8	18.1	21.4	27.7	26.9
GER	9.5	14.9	18.8	24.1	23.7
IT	15.3	17.8	24.0	28.9	31.8
Rainfall (mm)					
DK	31	30	50	49	75
UK	34	54	32	33	44
FR	25	32	49	22	62
GER	32	36	43	66	81
IT	49	65	55	30	5

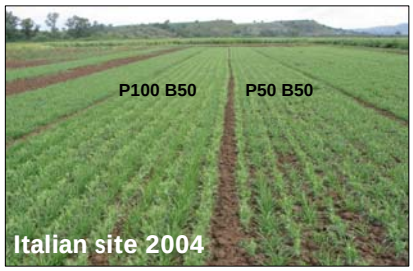
RESULTS

Grain yield (g·m-2) of pea and barley in ADD, REP series and SC in the different sites.
Mean ± SE values of 2003-2005.

	DK	FR	GER	IT	UK
SC					
Pea	208±34	213±48	402±63	385±24	265±35
Barley	303±12	269±22	373±20	319±35	292±9
ADD					
Pea	119±32	136±49	234±43	280±43	189±39
Barley	180±10	120±20	213±7	132±20	207±11
REP					
Pea	89±31	95±35	199±32	202±30	156±27
Barley	228±14	161±25	243±8	169±27	228±6

With exception of IT (0.72) and UK (0.70) pea showed about 40% yield reduction for the ADD series in another countries when compared with sole crop; on the contrary, barley sowed at ½ SC density highlighted a good performance in ADD mixture with a larger advantage in UK (0.72) and a slight yield reduction in IT (0.42).
In REP series a reduction in pea yield only for DK (0.44) and FR (0.43) was observed; while UK showed a considerable advantage (0.60). Cutting in half the pea sowing density in REP series, relative yield of barley was larger than 0.50 showing a very high value in DK and UK (0.83).

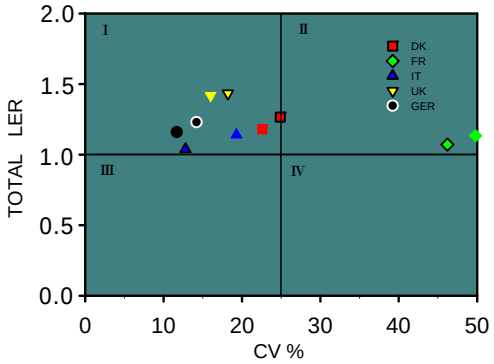
Seed drill
Contemporary sowing of barley and pea allowed by a double seed dispenser equipment



IC emergence in Italian site (30 das)
"Row by row" sowing pattern was used with 16 cm apart.

IC Pea barley at flowering

Harvest by combine



LER variability

Variability of additive (no-bordered) and replacement (bordered) series was calculated plotting CV% against total LER value. In the following way, 4 quadrant can be defined:

(I) high LER and low variability;

(II) high LER and high variability;

(III) low LER and low variability;

(IV) low LER and high variability.

Four out 5 Countries are positioned in the I quadrant representing the best situation between yield and stability. In both IC series, France showed IC advantage and high variability between the 3 years (II quadrant).

INTERCROP is a EU shared cost project under the 5th Framework Programme of RTD, Key Action 5 - Sustainable Agriculture

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