



Agronomic evaluation of legume-barley intercropping systems in a Mediterranean dry area



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INTRODUCTION

Global Cereal market and prices of commodities have been very unsteady during the last decades. Speculative actions of traders determined unsettled prices with negative consequences for farmers' income, simultaneously contributing to reduce the purchasing power of consumers in developing Countries.

More sustainable agricultural systems are necessary also in developed Countries, to avoid environmental risks with dramatic consequences for inhabitant of rural areas and cities. The role of legumes in rotation or intercropped with cereals could be essential to preserve the farmers' income and to reduce the abandoning of the agricultural land.

In Mediterranean area legume/cereal intercrop (IC) is common for forage production but few studies were carried out to evaluate grain production for feed or food destination. In the last half century legumes followed a drastic decline in Europe, but actually a new interest improved due to the deficit of internal production and the common interest in a more sustainable approach in the agricultural sector.

The aim of this study, was to assess the effects of field pea and faba bean intercropped with barley on the agronomic performance of an herbaceous system, on the use of natural resources and natural weed control.

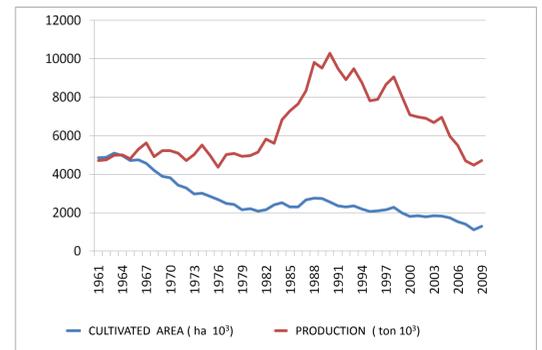


Fig. 1 Trend in surface and production of legumes in EU27 (Source: Faostat 2011)

MATERIALS & METHODS

SITE: San Marco Argentano (It) (39° 38'N, 16° 13'E, 100 m a.s.l.)

EXPERIMENTAL PERIOD: 2010-2011

SOIL: sandy clay loam (USDA classification) [see poster Tortorella et al.](#)

CLIMATE: Mean annual rainfall (709 mm); mean air temperature (16.1 °C) averages over 1995-2009

EXPERIMENTAL DESIGN: randomized block design with 4 replicated plots (25 m² each)

SPECIES: Medium early six-row Barley (*Hordeum vulgare* L. var. Aldebaran)

Faba bean (*Vicia faba* L. sub *minor* var. Sikelia)

leaf-less medium early, field Pea (*Pisum sativum* L. var. Hardy)

TREATMENTS: FSC, PSC and BSC (Sole crops sown at the recommended seed density of 40, 90 and 300 plants m⁻²)

P50/B50 and F50/B50 (Replacement design sown at half of recommended density)

P100/B50 and F100/B50 (Additive design with barley sown at half of recommended density)

F100/B50 (II) (Additive design with two rows of faba and one row of barley)

SOWING PATTERN: The different species were simultaneously sowed row by row 16 cm apart with a double hopper planter

CROP MANAGEMENT: fertilization at sowing (36 kg N ha⁻¹ and 92 kg P₂O₅ ha⁻¹) as diammonium phosphate.

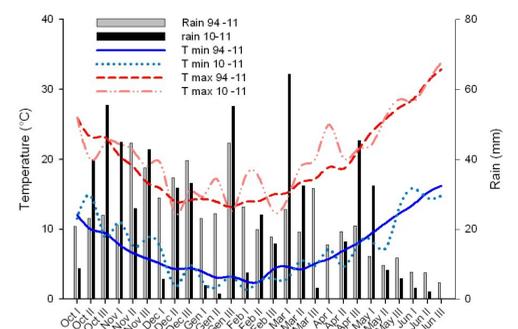


Fig. 2 Mean decadal rainfalls, minimum and maximum daily temperatures during crop season and as average of last 15 years.



RESULTS

Grain yield in barley and legume SC was higher compared with the regional historical yield, confirming a valid use for LER evaluation also for SC growth in systems with low fertilizer inputs.

The field pea/barley IC showed a better response than faba bean/barley IC particularly for P50/B50 where the reduction in grain yield of both partners compared to the respective SC was less than 20%. The higher response in field pea/barley IC could be explained by the better control of weeds (Fig. 3).

The presence of faba bean depressed the biomass and grain yield production of barley, also due to a low efficiency in suppression of spring weed in this system.

LER calculated on grain yield showed values higher than 1 in all IC treatments with an average land advantage of 62% for field pea/barley IC and 18% for faba bean/barley IC. Facilitation in the use of nitrogen (Ndfa%) and natural resources could explain these preliminary results (Tab. 1).

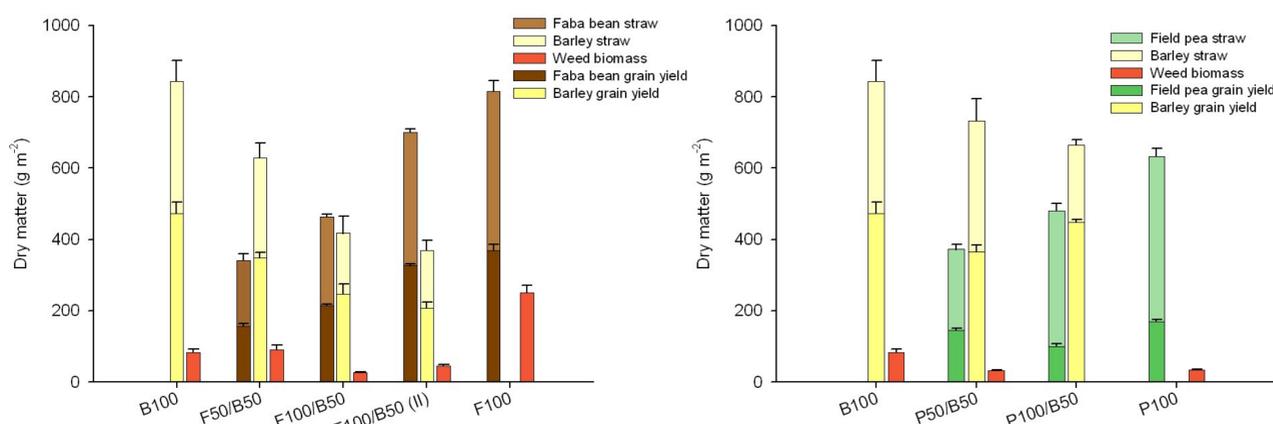


Fig. 1 total biomass of barley, legumes (separated for grain and straw) and weeds at harvest. Values are the mean (n=4 se)

	Ndfa (%)	Partial LER		LER
		Legume	barley	
F100/B50	76.8 ± 0.29	0.60 ± 0.13	0.53 ± 0.19	1.13 ± 0.09
F100/B50 (II)		0.87 ± 0.11	0.49 ± 0.25	1.36 ± 0.29
F50/B50	79.1 ± 0.31	0.44 ± 0.13	0.80 ± 0.31	1.23 ± 0.25
F100	76.0 ± 0.30			
P100/B50	83.3 ± 0.32	0.59 ± 0.11	0.97 ± 0.16	1.57 ± 0.15
P50/B50	85.9 ± 0.11	0.87 ± 0.20	0.81 ± 0.16	1.68 ± 0.18
P100	81.3 ± 0.64			

Tab. 1 N₂-fixation of legumes and Land Equivalent Ratio (LER) for the different IC treatments calculated for grain yield at harvest. Values are the mean (n=4 se)

CONCLUSION

As a whole, preliminary results indicated a better utilization of natural resources in cereal/legume IC systems, also confirmed by a higher N fixation of legumes and a higher protein content in the grain of barley, avoiding external inputs and reducing the impacts on the agroecosystem. These positive results, if confirmed, could determine a saving of net farmers' income in low input agricultural systems of Mediterranean area.