Intercropping of cereals and grain legumes for increased production – provisional results of plot trials in Northern Hesse, Germany

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Introduction:

Intercropping of cereals and grain legumes is a neglected theme in agricultural practice and science, both, conventional and organic. In 1998 less than 10.000 ha of organic crops (~5% of the arable land in Germany) were cultivated in an intercropping system. It can, however, be an alternative to sole crops in order to improve yield and yield stability. Seed rates and techniques may influence the effect of intercrops on yield and yield stability.

Objective:

To determine the effects of different seed rates (SR) and two seed techniques (ST) in intercropping systems.

Materials and methods:

The field trial was carried out at the Hessian State Estate Frankenhausen located in Central Germany (51°25'N, 9°25'E). The soil was a Cumuli Anthrosol. Spring barley (*Hordeum vulgare* cv. Scarlett) and field pea (*Pisum sativum* cv. Baccara) were sown as

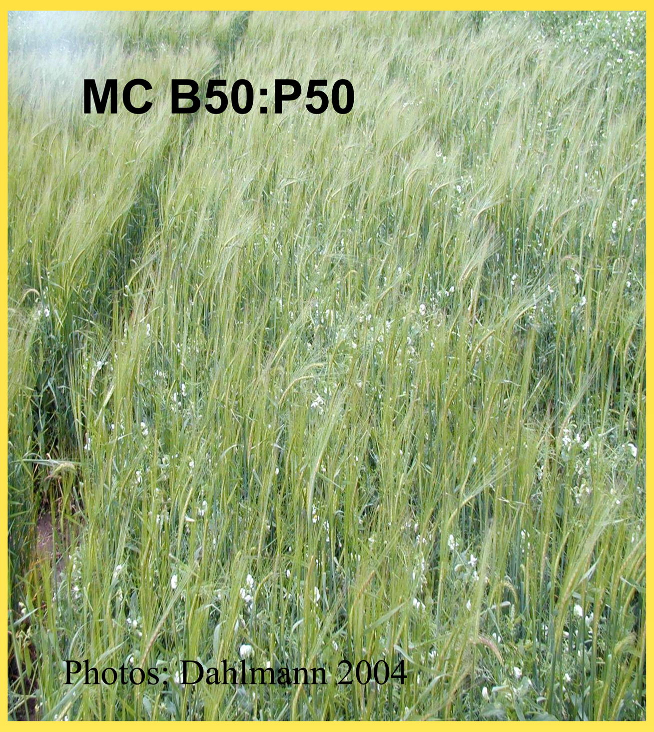
- Sole crops: Spring barley (B) and field pea (P)
- Intercrops in the substitutive design [%] (B25:P75; B50:P50; B75:P25)
- Intercrops in the additive design (B50:P100)

at April 1st 2004.

All mixtures were applied using two seed techniques:

- Row Intercropping (IC), {species differed from line to line}
- Mixed Intercropping (MC), {species differed within the same line}

All presented data refer to the cultivation year 2004.



Results and discussion:

The yields were influenced in the spring barley / field pea trial by a high infestation of field pea by aphids and spring barley by brown rust (*Puccinia hordei*). Apart from the MC 25:75 mixture, the intercrops had higher total grain yields than the sole crops (Fig. 1). All Land Equivalent Ratios (LERs) were >1 (Tab. 2). The intercropping yields were dominated by spring barley. For this reason the intercropping mixtures with a barley seed rate lower than 50 % achieved the lowest yields. The influence of factor ST was not significant (Tab. 1). Two IC mixtures (IC B25:P75; IC B75:P25) reached a higher total yield than their MC counterparts.

According to this the mixtures MC B50:P50 and MC B50:P100 had higher total yields than the IC mixtures. Especially the MC B50:P100 mixture show, that intraspecific competition of plants has a strong influence on yield. The distribution of the species in the MC mixture was obviously more adequate to improve yield than in the IC mixture.

The interspecific competition had no decreasing influence on yield. The mixtures with the highest plant density achieved LERs of 1.28 (IC B50:P100) and 1.40 (MC B50:P100).

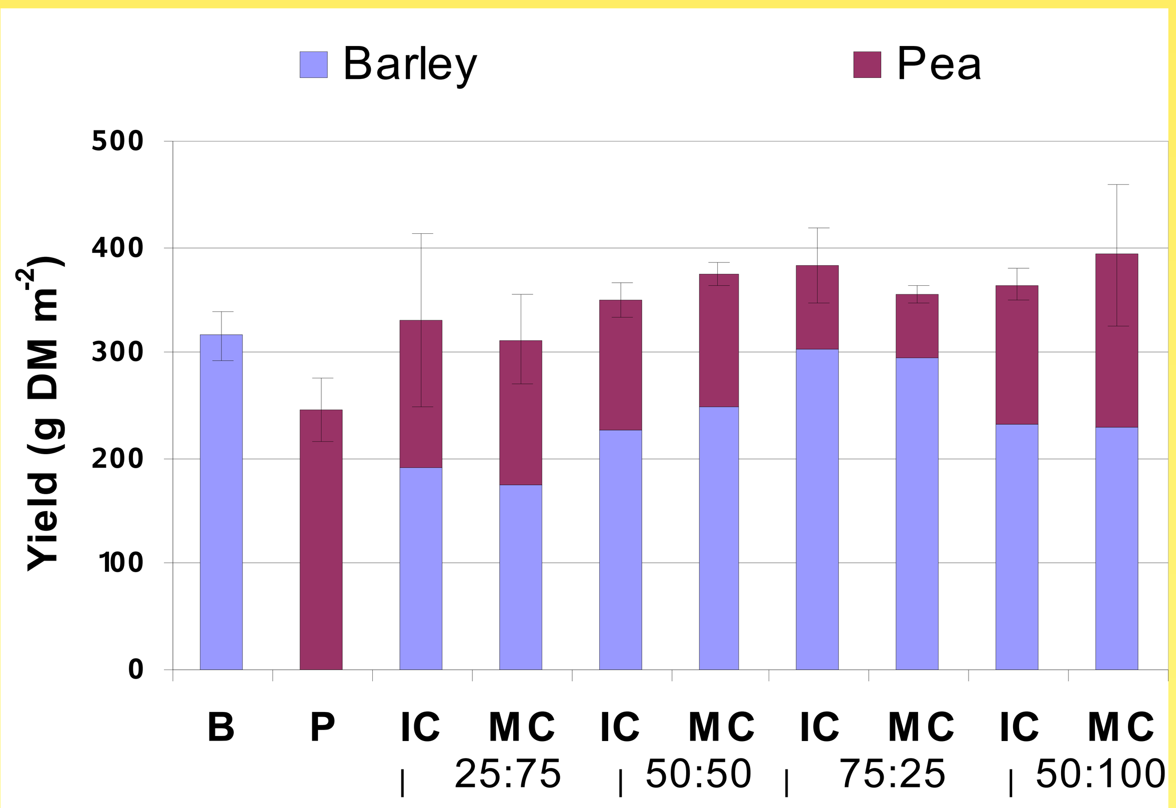


Figure 1: Total grain yields from the sole crops spring barley (B), field pea (P) and four different intercropping seed rates, each in two seed techniques (IC, MC) and standard deviation of total grain yields

Table 1: Effect of seed rate (SR) and technique (ST) on yield

	p-value	Significance
SR	0.000	***
ST	0.361	ns
SR x ST	0.457	ns
Replicate	0.397	ns

ns = $p > 0.05$; *** = $p < 0.001$
ANOVA

Table 2: LERs in different mixtures and ST (IC, MC)

	LER	
Mixtures	IC	MC
B25:P75	1.20	1.13
B50:P50	1.23	1.32
B75:P25	1.30	1.20
B50:P100	1.28	1.40

Conclusions:

Intercropping is an interesting system to improve yield especially in organic farming systems with its limited resources. The results in 2004 show, that (a) intercropping is able to increase total grain yield compared to sole crops (depending on seed rate) and (b) MC-Intercropping (better suited to farming practice) achieved similar results to IC-Intercropping.