Pea-barley intercropping for efficient symbiotic N-2-fixation, soil N acquisition and use of other nutrients in European organic cropping systems

Complementarity in acquisition of nitrogen (N) from soil and N-2-fixation within pea and barley intercrops was studied in organic field experiments across Western Europe (Denmark, United Kingdom, France, Germany and Italy). Spring pea and barley were sown either as sole crops, at the recommended plant density (P100 and B100, respectively) or in replacement (P50B50) or additive (P100B50) intercropping designs, in each of three cropping seasons (2003-2005). Irrespective of site and intercrop design, Land Equivalent Ratios (LER) between 1.4 at flowering and 1.3 at maturity showed that total N recovery was greater in the pea-barley intercrops than in the sole crops suggesting a high degree of complementarity across a wide range of growing conditions. Complementarity was partly attributed to greater soil mineral N acquisition by barley, forcing pea to rely more on N-2-fixation. At all sites the proportion of total aboveground pea N that was derived from N-2-fixation was greater when intercropped with barley than when grown as a sole crop. No consistent differences were found between the two intercropping designs. Simultaneously, the accumulation of Phosphorous (P), potassium (K) and sulphur (S) in Danish and German experiments was 20% higher in the intercrop (P50B50) than in the respective sole crops, possibly influencing general crop yields and thereby competitive ability for other resources. Comparing all sites and seasons, the benefits of organic pea-barley intercropping for N acquisition were highly resilient. It is concluded that pea-barley intercropping is a relevant cropping strategy to adopt when trying to optimize N-2-fixation inputs to the cropping system.

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