

Managing the Competition in Cereal-Subclover-Systems

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Abstract

The success of the establishment of living mulch systems in cereals depends, among other factors, on the spacial seed arrangement of the main crop and the associated crop as well as on the nitrogen availability. A series of experiments with three different types of seed arrangement has been performed in southern Germany and central Italy in order to assess the role of this factor using model systems with wheat and subterranean clover. The effect of nitrogen availability was tested in a separate experiment with 12 different levels of N fertilization. The best seed arrangement was narrow alternate rows, where competition between crops is reduced in the early growth stages. At higher N fertilization rates, subterranean clover was suppressed; however, at yield levels, typical for organic farming (3-6 t/ha), the establishment of a subclover canopy under wheat is possible.

Introduction and objectives

Associated crops (living mulches) may improve the sustainability of cropping systems, but competition by the associated crop often reduces productivity. Among many other factors, competition by an associated crop is influenced by the spacial seed arrangement and the level of N availability. Aim of the studies presented in this contribution was, to investigate the effect of both factors on competition between wheat and subterranean clover associated as living mulch, in order to optimize the balance between the two crops.

Methods

Three different spatial seed arrangements in intercrops of bread wheat cv. 'Achat' and subterranean clover (*T. subterraneum* L.) cv 'Campeda' were compared in field experiments performed at Freising (upper Bavaria, Germany) and at Viterbo (central Italy) between 2012 and 2014: (i) narrow alternate rows, i. e. 1 row of clover was alternated with two rows of wheat at row distances of 10 cm, (ii) wide alternate rows, i. e. one double row of wheat (10 cm distance) was alternated with single rows of clover at a distance of 17.5 cm and (iii) clover and wheat mixed within the row at 15 cm row distance. As control, wheat and clover were grown alone at 15 cm row distance. The trials were performed both under organic and under conventional conditions, the latter comprising two levels of N fertilization (50 and 100 kg/ha N as Urea, split in 2 applications at higher N levels). In an additional trial, 12 different levels of N fertilization were applied, ranging from 0 to 350 kg/ha.

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Results and discussion

In most experiments, the overall yield response of wheat on competition by subterranean clover was either only slightly negative or even absent (Fig. 2). Relatively high yields with a reasonable canopy of subterranean clover could be achieved in narrow alternate rows. Strong competition in early growth stages may have a negative influence on the development of the subclover canopy where clover and wheat were mixed within the same row. Due to lower overall density, wide rows may decrease both wheat yield and the development of subclover. Narrow alternate rows seem therefore to be the best method. The same tendencies could be observed at both fertilization levels. In the additional trial, increasing N availability increased wheat yield and decreased clover biomass (Fig. 1). Subclover canopies with a good reproductive potential could be obtained at yield levels of 6-7 t/ha.

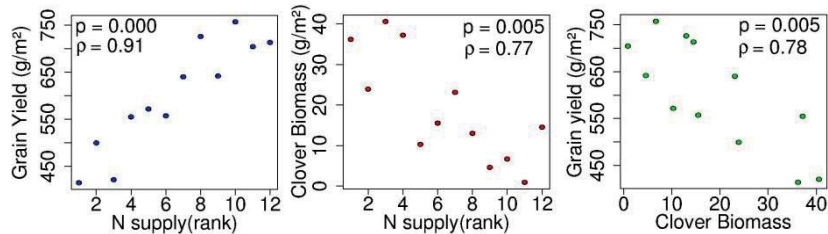


Figure 1: Relations among N fertilization level, grain yield and clover biomass at maturity. ‘ρ’ denotes Spearman’s rank correlation coefficient, ‘p’ refers to ‘p’:

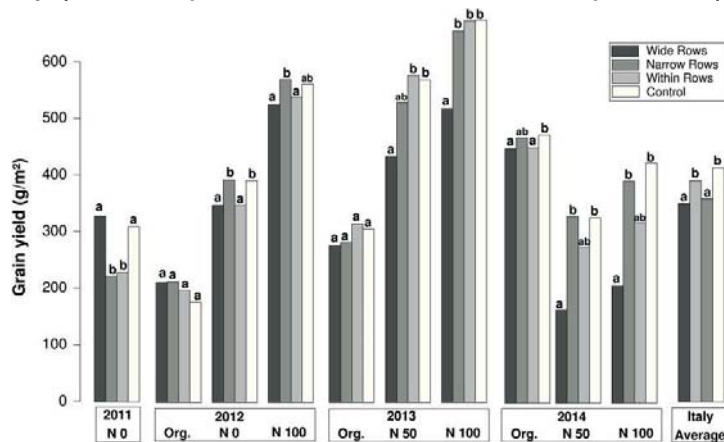


Figure 2: Effect of seed arrangement of wheat and clover on grain yield, results of several experiments, 2012-2014; Org: Experiments with Organic management; ‘N 0’–‘N 100’ , conventional management with different levels of N fertilization. Bars with different letters are significantly different according to Tukey’s HSD-Test (p<0. 05).

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