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Innovative strategies for weed control in organic spinach and cauliflower

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Introduction

Weed control is a major obstacle in organic vegetable systems due to the often poor competitive ability of vegetable crops. To improve weed control and increase crop performance it is important to diversify weed management strategies (WMS) with use of green manures, mechanical weeding and crop diversification. The aim of this study was to test WMS at different level of innovation on crop performance and weed dynamics.

Methodology

An on-farm research was carried out in 2006-2008 at the Colombini vegetable organic farm, located in Crespina (Pisa), central Italy. The soil was a sandy-loam, with an organic matter content of 1% and a pH of 6.8. We tested two innovative crop and weed management systems and a standard system on a spinach-potato-cauliflower-tomato sequence. The trial was arranged according to a randomised complete block (RCB) design with three replicates (each block corresponding to one field). The standard (farmer's) system consisted in manual transplanting on biodegradable maize starch mulch (MaterBi®). No direct weed control measures were applied. This was compared with two innovative crop and weed management systems based on different levels of technical innovation: the 'intermediate' and 'advanced' systems. The ntermediate system was based on a sequence of diverse direct physical weed control (PWC) operations. The advanced system included the same PWC treatments of the intermediate system plus two living mulches: subterranean clover (Trifolium subterraneum L.) in spinach (Spinacia oleracea L.) and hairy vetch (Vicia villosa Roth.) in cauliflower (Brassica oleracea L.). Spinach was sown on 5 October 2006 by means of a pneumatic driller while cauliflower was transplanted on 13 September 2007. Subterranean clover (cv. Clare) and hairy vetch (cv. Villana) were broadcast interseeded respectively in spinach (20 November 2006, seeding rate of 30 kg ha $^{-1}$)and cauliflower (5 October 2007, seeding rate of 90 kg ha $^{-1}$). All data collected were subjected to ANOVA.

Results and Conclusions

Here we present the results obtained on spinach and cauliflower in terms of crop yield component, weed suppression and crop/living mulch competition. In both crops we observed a higher fresh yield in the innovative systems compared to the standard one, despite a significantly higher total weed biomass which, however, was low in absolute values. Overall, the two innovative systems had a higher fresh production compared to the standard system: +26% in spinach) and +63% in cauliflower. In both crops, presence of the living mulch had no appreciable effect on fresh yield and weed biomass during the growing cycle of spinach and cauliflower, meaning that no negative effects of crop/living mulch competition was detected. The presence of living mulch increased the amount of crop residues incorporated into the soil of about 75 and 33% with respect to the intermediate system in case of subterranean clover and hairy vetch respectively. Moreover, the living mulch, which continued to grow after the end of the crop cycle, suppressed weed growth in the period between crop harvest and seedbed preparation for the next crop (+33% with subclover and +55 % with vetch, as compared with the intermediate system). This effects was more pronounced in vetch than in subterranean clover probably due to the delay and the sowing methods that caused a sub-optimal growth of clover. This results suggest that coupling physical weed control with use of a living mulch can further increase the weed suppression potential of an organic vegetable cropping system. This also ensures that the increment of organic matter incorporated into the soil maintaining yields comparable to those of the intermediate system.