

Peach Aphids Management in Organic and Conventional Orchards: How to reconnect efficiency and ecology?

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Keywords: aphids, conventional, organic, peach, crop protection, strategy

Abstract

Considering the various negative side effects of intensive chemical pest control practices, a fundamental shift toward alternative approaches for crop protection is at stake in the agricultural sphere. The control of peach tree aphids requires regular and numerous treatments to achieve protection against direct damages and virus transmission. However, aphids' populations are known to be affected by cultural practices and their effects on plant growth, and by natural regulations. In 2007, we identified and evaluated the protection strategies applied in 20 commercial fruit farms (8 in organic farming and 12 in conventional agriculture) in the south of France. We used different data sources: comprehensive interviews, peach orchard protection schedules, and monitoring of aphids and beneficial populations at plot level. We also monitored the growth of shoots and fruits to evaluate the trees' vigor. As a first result, four strategies were identified from comprehensive variables including decision rules and protection methods implemented: chemical and alternative methods, number and scheduling of treatments, efficacy on aphids, and toxicity on beneficials. We showed that the two most efficient strategies on all aphid species also affect the smallest populations of beneficials. These strategies were prevalent with conventional farmers; they consist in using several aphids-specific chemical products before and after the blossom period. A third strategy is mostly represented by a group of organic fruit growers enhancing input-substitution behavior, that is, applying many of the products that are eligible in organic farming specifications. The last strategy is the most integrative in terms of knowledge and cultural and alternative methods. It is only applied by organic farmers. The two strategies implemented by organic farmers lead to heterogeneous and important populations of aphids. Direct pest control with mineral oil is preventive and takes place before flowering. In addition, a set of both preventive and cultural methods enables the management of parasitism as a whole. Then, the comparison between organic and conventional plots shows a significant difference in beneficial' population, more prevalent and diversified in organic systems. Indeed, the toxicity ratio calculated from the strategies is lower in organic farming. A high level of trophic resources probably generates a higher level of beneficials. Aphid species are significantly different between the two patterns. Indeed, organic plots' vigor is significantly lower than in conventional ones. According to the literature, the various strategies identified can be interpreted as steps toward a redesign of orchard protection. Therefore, transitions would be possible to achieve strategies using less chemical inputs. However, ecological intensification and efficiency appear to be incompatible. Since no cultivars resistant to all aphids have yet been developed, interventions such as management of ecological infrastructures (flower strips, edges . . .) and prevention of dioecious aphids' return in autumn can be conceived to keep an acceptable level of pest populations in organic orchards. Such an evaluation of strategies should refer to farmers' protection and production objectives such as yield, quality, biodiversity, environment, and inputs management.

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