Physical protection barriers against pests and diseases, a multi crop experience

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Abstract

Organic agriculture regulations allow only a limited number of plant protection products (PPPs), and the use of a few of them, as in the case of copper application, are becoming more restrictive. Furthermore, organic farmers are challenged by new threats, caused by climatic changes (e.g., higher survival rate of fungi and pests in the winter time) and by the introduction of alien species (FAO, 2019), phenomena that are not easily controlled by current PPPs. Physical barriers help to protect crops against diseases and pests, and therefore represent a possible strategy to produce fruits using only a limited number of PPP treatments per year (Chouinard et al., 2019). At present, experience has been gained for only a small number of fruit species. For that reason, combined rain and pest protection nets were tested on different crops and cultivars to evaluate the potentials and limits of these systems. The first results obtained with cherries, grapes, and different apple varieties showed a marked reduction in pre- and post-storage fungal infections, and due to the lateral nets, pest damages decreased as well. The results obtained on apricot are not yet satisfactory.

Keywords: physical barriers, plant protection products reduction, organic agriculture

Introduction

During the last ten-year companies started to develop and sell rainproof roofs, to reduce leaves wetness and avoid favourable conditions for fungal diseases to spread. The products proposed by the different companies include plastic sheets and micrometric nets of various width and thickness, usually built in PEHD, that can be positioned above, under or instead of the current anti-hail nets. The system design vary from mono-block to single-row nets associated to exclusion nets.

Material and methods

The netting system named “Keep in touch Antiacqua” (KT), due to its double micrometric net roof, keeps the trees dry and reduce fungal infections spread. This system combines the rain-roof with exclusion nets that offer protection against pests. In the case of stone fruits, the lateral nets mesh size was finer than the mesh used on apples, to protect the fruits also against *Drosophila Suzukii*. In all the trials, PPP treatments were carried out from the beginning of the season till the opening of the KT system. After that moment, no more PPP treatments were performed. The three-year trial on Pink Lady® started in 2016, while on Fuji apples, due to the reduce scab pressure in the field, the trail lasted only two years (2017-18). Trials on stone fruits, wines, and Evelina® started in 2018, while on Gala apples, trial started in 2019. In all the trials, KT was compared with an untreated control (CN), while in the case of the trial on Gala, the results were also compared to a third thesis (BIO), sprayed with organic PPPs. In the vineyard, KT consisted only of the rain-roof, without any lateral anti-insect nets, and was opened the first week of April.

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Results and discussion

The autumn evaluation of Fuji leaves in 2017 and 2018 clearly shows how the scab infection in KT was considerably lower when compared to CN. Primary scab infection on KT and CN fruits of both years was almost absent, but in 2017, 11.4% of the CN fruits were infected by sooty blotch, while less than 1% of the KT apples showed those symptoms. On Gala apples, KT and BIO both showed significantly lower levels of primary and secondary scab infection than CN. No significant differences were found for *Alternaria* and for cracked fruits, while during the harvest, significantly lower levels of rotten apples were found in KT. The lateral nets sharply decreased pest damage. 21.7% of the apples in BIO were damaged by *C. pomonella* and 27.9% were damaged by other masticatory pests, while under the KT system, only 2% and 7.8% were damaged, respectively by *C. pomonella* and by other pests. There is a clear effect on the storability of the apples too, as shown in the three-year trial on Pink Lady® apples (Fig.1). In 2018, after the storage of Fuji apples, the rotten CN fruits were almost 30%, significantly higher compared to 5.7% reached by KT. The shelf-life evaluation yields similar results; the rotten KT apples were 6.7%, while in CN almost 17%.

The current results on apricot trees are not positive yet, as the *Monilia* infection reduction in 2019 was compensated by an increase in *Corineum spp*. and sooty mold infections. The results on cherries are positive: There was a reduction of all the pre- and post-storage diseases, pest damages, and cracked fruits. Even if the pest and disease pressure in 2018 was not high and CN showed acceptable losses, KT still allowed a gain of +23% in the pre- and of +36% in the post-storage of healthy and marketable fruits.

The KT on Merlot and Ruländer in 2019 reduced the downy mildew summer infection on leaves and grape compared to CN, but the infection rate in September was not acceptable for any producer. Furthermore, the leaves protected by KT became more susceptible to powdery mildew, and so was the grape.

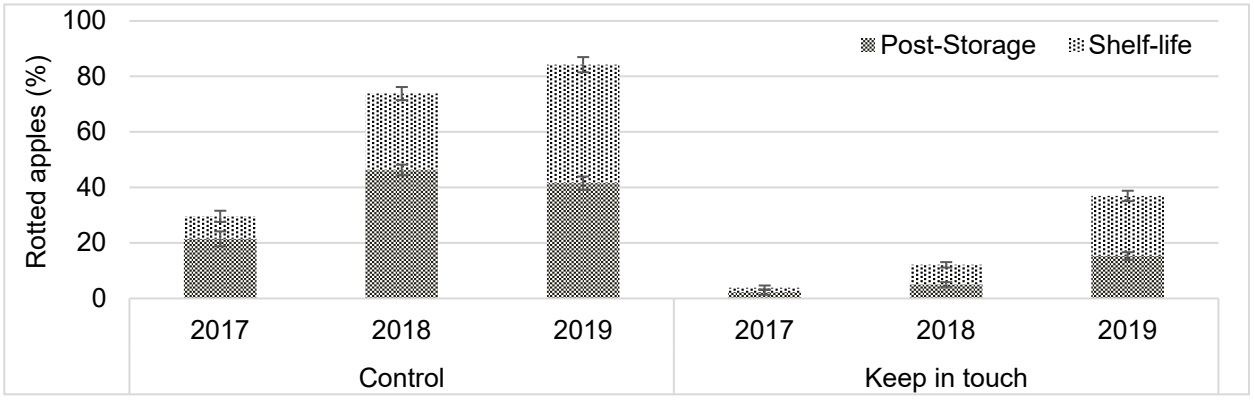

Figure 1: Rotten Pink Lady® apples (mean ± SE) after winter storage and shelf-life. The losses in control are significantly higher than the losses measured in “Keep in touch Antiacqua”.

Conclusion

The “Keep in touch Antiacqua” yielded a drastic reduction in fungal diseases like apple scab, pre- and post- storage rottenness, sooty blotch, and downy mildew infection in summer, but it enhanced other fungal diseases, like powdery mildew on leaves and grapes in the vineyard and *Corineum spp*. on apricots.

References

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