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# Testing the effect of a weather protection on the apple production regarding disease and pest damages

## Introduction

Table apple production requires an intense direct plant protection in order to reach the fruit quality demanded by the market. Since plant protection is primarily used against fungi (apple scab, sooty blotch etc.) and pests (codling moth, aphids etc.), one approach to reduce the application of plant protection products in intensive organic apple orchards is the use of a physical barrier to protect the trees and fruits against rain and insects. The rain coverage is expected to reduce fungal infections as most fungi need a water film to infect the plant. The weather protection tested in this study combines a film for rain protection above the trees with an insect net on the side, and is marketed as "Keep in touch – Antiacqua" system. In this study it was set up as an incomplete exclusion net since the soil was included in the enclosed area.

## Material and Methods

**Trial location:** organically managed apple orchard at FiBL in Frick (Switzerland, 350 m.a.s.l., around 1000 mm precipitation per year)

**3 treatments**

- Keep in touch: Rainproof protection net (*) & no plant protection
- Organic: No rainproof protection net & standard organic plant protection
- Control: No rainproof protection net & no plant protection

**Repetitions:** 3 repetitions with 5 to 11 trees per repetition, 2 apple varieties (Topaz, Ariwa)

**Assessments**

- Insect diversity: beating tray (April, August)
- Fungal infections on leaves: apple scab assessment mid-June
- Fungal infections and pest damages on fruits at harvest
- Fungal infections during storage

**Fig.1** "Keep in touch – Antiacqua" weather protection system.

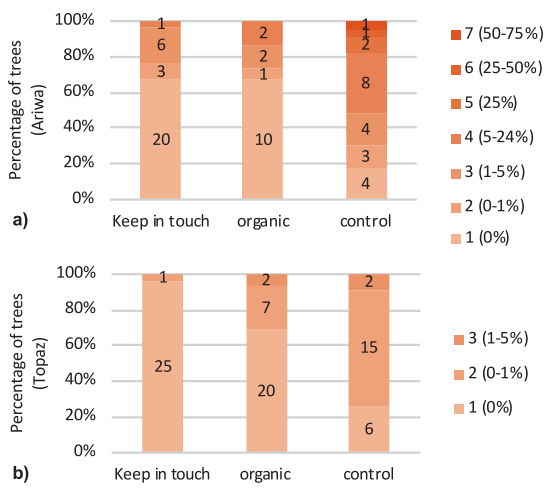


**Fig. 2** Apple scab assessment according to Patocchi et al. (2009) per treatment for the variety Ariwa (a) and Topaz (b).

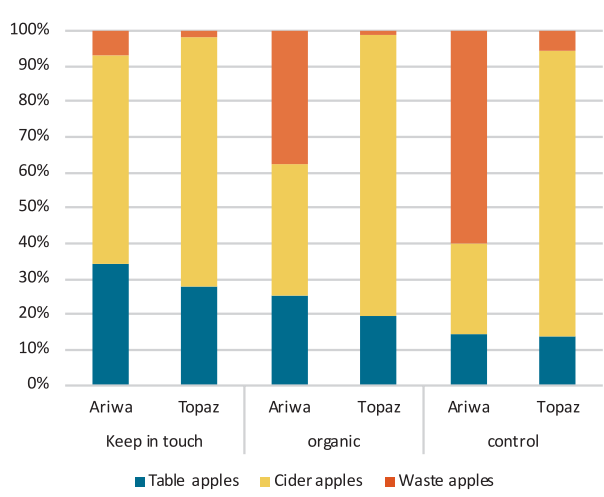


**Fig. 3** Weight proportion of marketable fruits (table apples), apples for cider production (cider apples), and waste apples for the "Keep in touch" treatment, the "organic" treatment, and the control.

| Fruit assessment | Effect |
|---|---|
| Fallen fruits | ↓ |
| Deformed fruits | ↑ |
| Underdeveloped fruits | ↑ |
| Insect damage | ↓ |
| Aphid damage | ↑ |
| Rotten fruits | ↓ |
| Lenticel rot | ↓ |
| Sooty blotch | ↓ |
| Bitter pit | ↓ |
| Fruit weight | ↓ |
| Sugar content | ↓ |
| Overcolour | ↓ |

**Fig. 4** Effect on fungal infections and pest damages on fruits at harvest (↑ = increase, ↓ = decrease, green = positive, red = negative).

## Discussion

The results of the season 2019 showed that the rain coverage combined with a net can …

- decrease scab infections as well as fungal diseases on fruits at harvest such as lenticel rot or sooty blotch → reduction in microcracks at the surface of fruits? (Chouinard et al. 2019)
- have a positive effect on fruit storability and shelf-life
- decrease insect damage caused by feeding insects, but enhance aphid development → exclusion of pests, but also of beneficial insects, effect on the microclimate under the net (Alaphilippe et al., 2016; Aoun, 2016; Manja et al., 2019)
- increase the number of underdeveloped and deformed fruits → negative effect on fruit pollination? (Kelderer et al., 2014)
- affect fruit quality
  - Lower sugar content → light limitation?
  - Lower red overcolour of fruits → light limitation? temperature buffer effect? (Gouws et al., 2014)
  - Decrease in fruit weight → usually increase in fruit weight due to thinning effect (Kelderer et al., 2014; Chouinard et al., 2019)

The effects on both varieties (Ariwa, Topaz) were similar. All the here presented results are from the first season of this trial i.e. from only one year. All the assessments will be repeated in the season 2020 and presumably 2021 to verify the here presented results.

**References**

Alaphilippe, A., S. Simon, Y. Capowiez and M. Saudreau (2016)
Aoun, M. (2016)
Chouinard, G., J. Veilleux, F. Pelletier, M. Larose, V. Philion, V. Joubert and D. Cormier (2019)
Kelderer, M., E. Lardscheider and A. Rainer (2014)
Manja, K. and M. Aoun (2019)
Patocchi, A., A. Frei, J. E. Frey and M. Kellerhals (2009)

(*) the protective system was opened (i.e. the trees were covered) during full flowering (phenological stage BBCH 65), and from this point in time no more plant protection products (PPT) were used for that treatment.

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