



BIOFRUITNET

Boosting Innovation in ORGANIC FRUIT
production through stronger networks

Different approaches to regulate the black cherry aphid (*Myzus cerasi*) in organic table cherry production

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FiBL

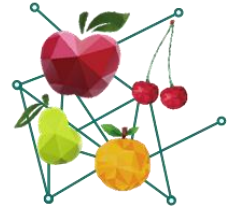
BIOFRUITNET PROJECT
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Presentation Outline

1. Introduction
2. Approaches tested at FiBL
3. Conclusion



Black cherry aphid (*Myzus cerasi*)



- Main pest in modern organic table cherry production with installed rain protection + insect nets
- Strong aphid populations can build up:
 - Favourable microclimate
 - Less aphid antagonists (e.g. hover flies, lacewings or ladybirds)
 - **Tree damages: plant growth is slowed down**
 - **Yield losses: fruits get attacked by fungi and become black and sticky**
- important vector of plant viruses



Black cherry aphid (*Myzus cerasi*) – life cycle



- Main hosts: sweet cherry (*Prunus avium*) and sour cherry (*Prunus cerasus*)
- Fundatrices hatch from eggs March – April. Due to asexual reproduction, every fundatrix reproduces exponentially (50-200 nymphs), which makes early control crucial
- From June on *M. cerasi* migrates to secondary hosts:

Veronica spp. (Plantaginaceae)



source: wikipedia.org

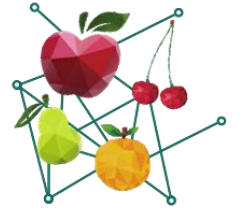
Galium spp. (Rubiaceae)



source: wikipedia.org

- In autumn, winged females (gynoparae) migrate from their secondary hosts back to the cherry orchards and produce wingless oviparae. Winged males, which migrate later, mate with oviparae, which then lay eggs at the base of buds, in crevices of the bark and on young shoots.

Black cherry aphid (*Myzus cerasi*) – direct regulation



Possible stages for direct regulation

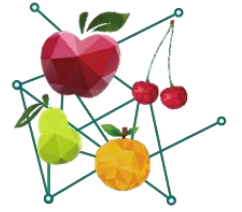
- Oil products **before the hatching** of the fundatrices in spring at sprouting
- Contact insecticides **after the hatching** of the aphids but before curling of the leaves caused by the sucking activity of the aphids
- During **return flight** of the winged aphids from secondary hosts to the cherry trees but before laying of eggs

Current recommendation in Switzerland

- 1-2 treatments with paraffin oil at sprouting
- Pyrethrum + Natural (soap) after flowering
- NeemAzal T/S (azadirachtin) after flowering (slow effect)
 - Old trees: leaf damages possible, prevention of strong deformations of shoots and fruit contaminations
 - Young trees: strong aphid damages due to slow mode of action
→ **additional early treatment with fast effect important**



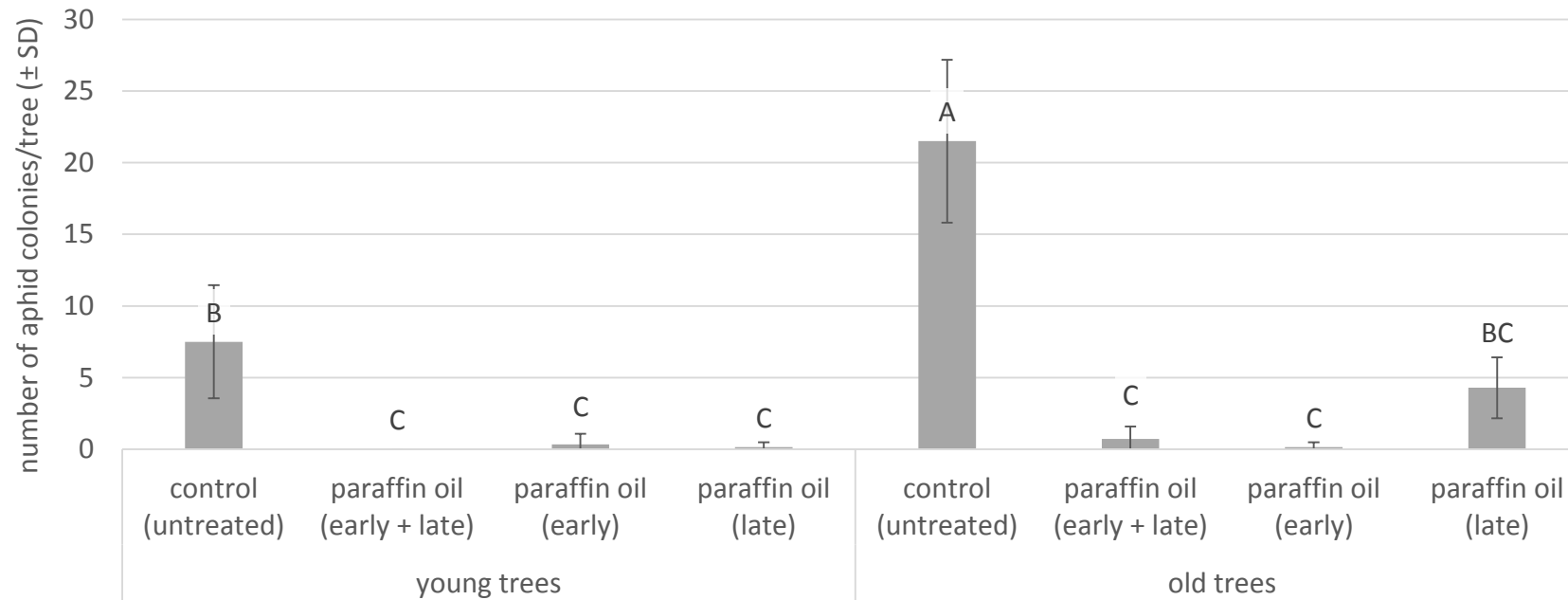
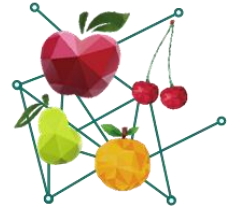
Trial I 2017 – experimental design



- Trees of varieties Kordia (2013) and Merchant (2008)
- Treatments
 - «early»: paraffin oil 15.03.2017
 - «late»: paraffin oil 27.03.2017
 - «early + late»: paraffin oil 15. & 27.03.2017
 - control (untreated)
- Number of aphid colonies assessed on the 27.04.2017

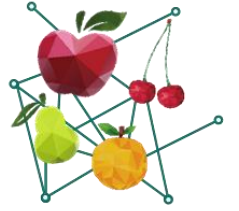


Trial I 2017 – results



- Number of aphid colonies significantly reduced in all treatments
- Better effect on younger trees
- Weakest effect with 80 % reduction on old trees in treatment «late»

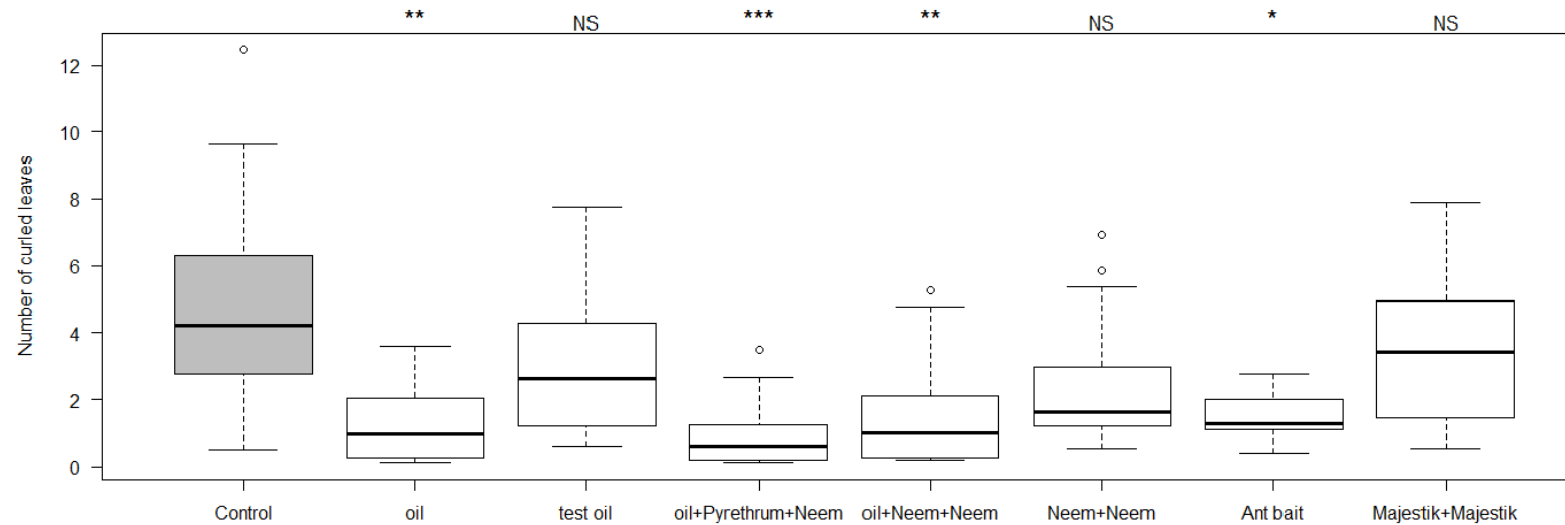
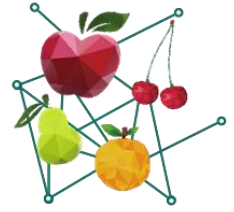
Trial II 2017 – experimental design



Treatments:

1. one application of paraffin oil after bud swelling followed by Pyrethrum before flowering and one Neem oil application after flowering
2. MAJESTIK ® (maltodextrin) applied before and after flowering
3. a test oil (Linseed oil) applied after bud swelling
4. sugar bait dispensers installed after bud swelling

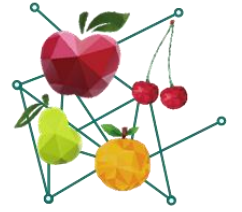
Trial II 2017 – results



Source: Cahenzli & Daniel (2018)

- The standard paraffin oil controlled the black cherry aphid
- Additional treatments with Pyrethrum and Neem oil added no further efficacy to the programs
- The test oil (Linseed oil) was clearly less efficient than the standard paraffin oil
- The two applications of Majestik (maltodextrin) did not significantly control aphids
- Ant bait dispensers (sugar) mounted to the stems showed interesting results.

Trial 2018 – experimental design



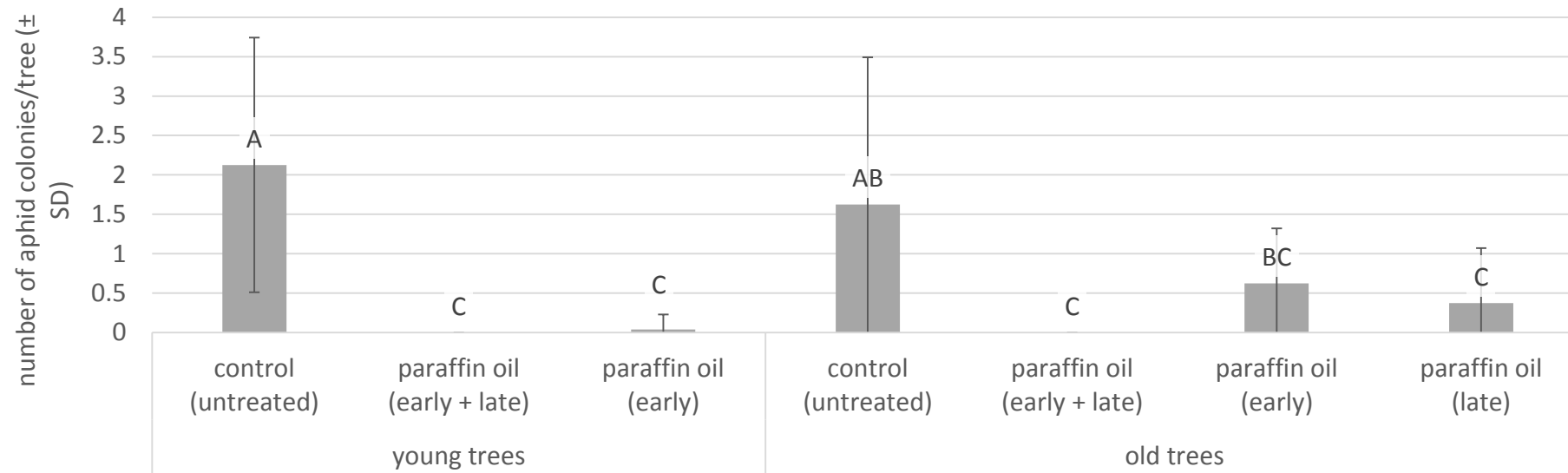
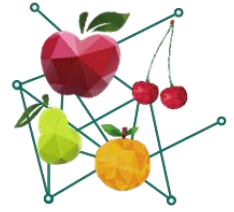
Trial with paraffin oil

- Trees of varieties Kordia (2017 and 2013) and Christiana (2017)
- Treatments
 - «early»: paraffin oil 02.04.2018
 - «early + late»: paraffin oil 02. & 06.04.2018
 - control (untreated)
- Number of aphid colonies assessed on the 13.04.2018

Trial with pyrethrum + soap

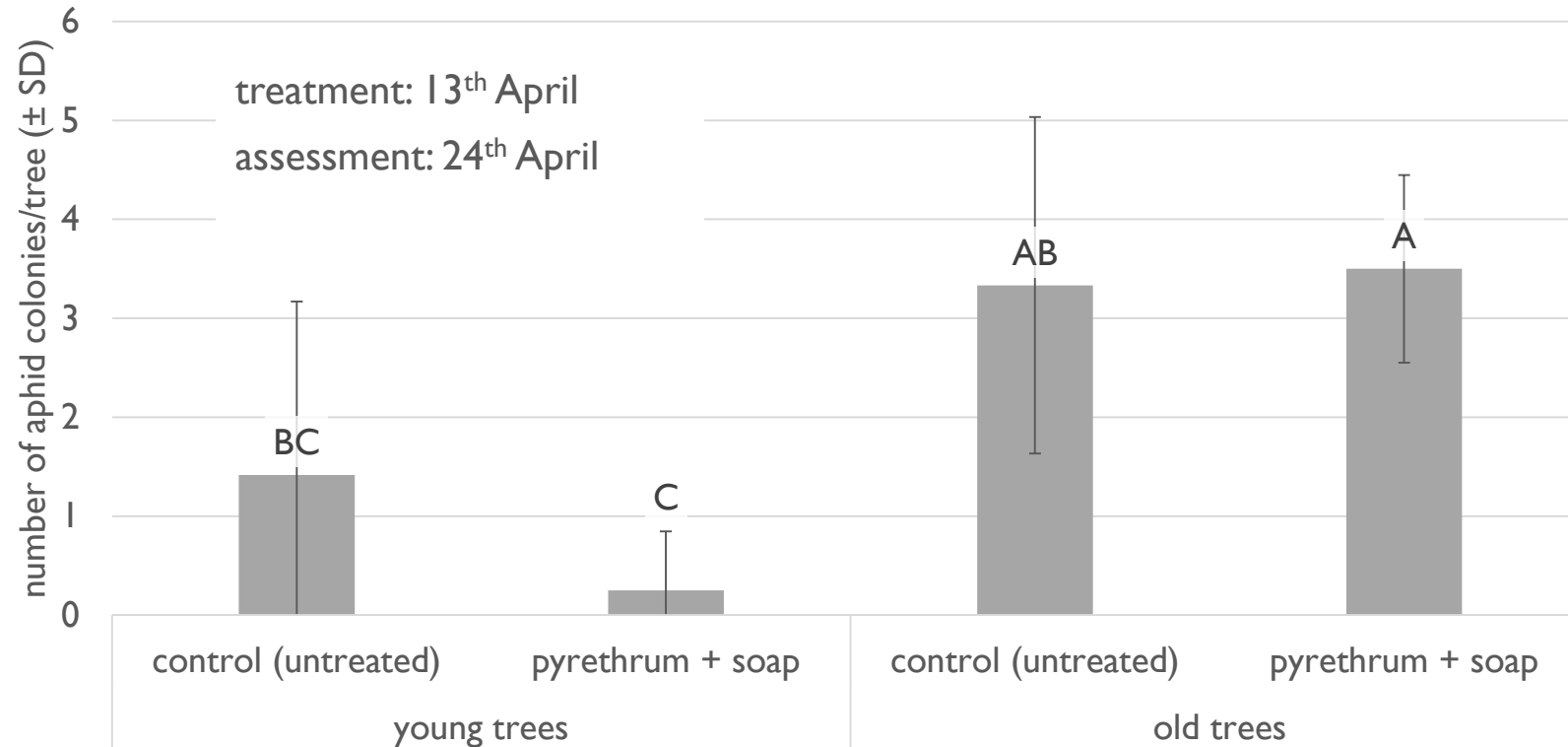
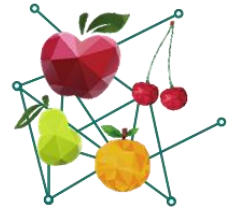
- Trees of varieties Kordia (2017 and 2013) and Christiana (2017)
- Treatments
 - Pyrethrum (Pyrethrum FS) + soap (Natural)
 - control (untreated)
- Number of aphid colonies assessed on the 24.04.2018

Trial 2018 – paraffin oil – results



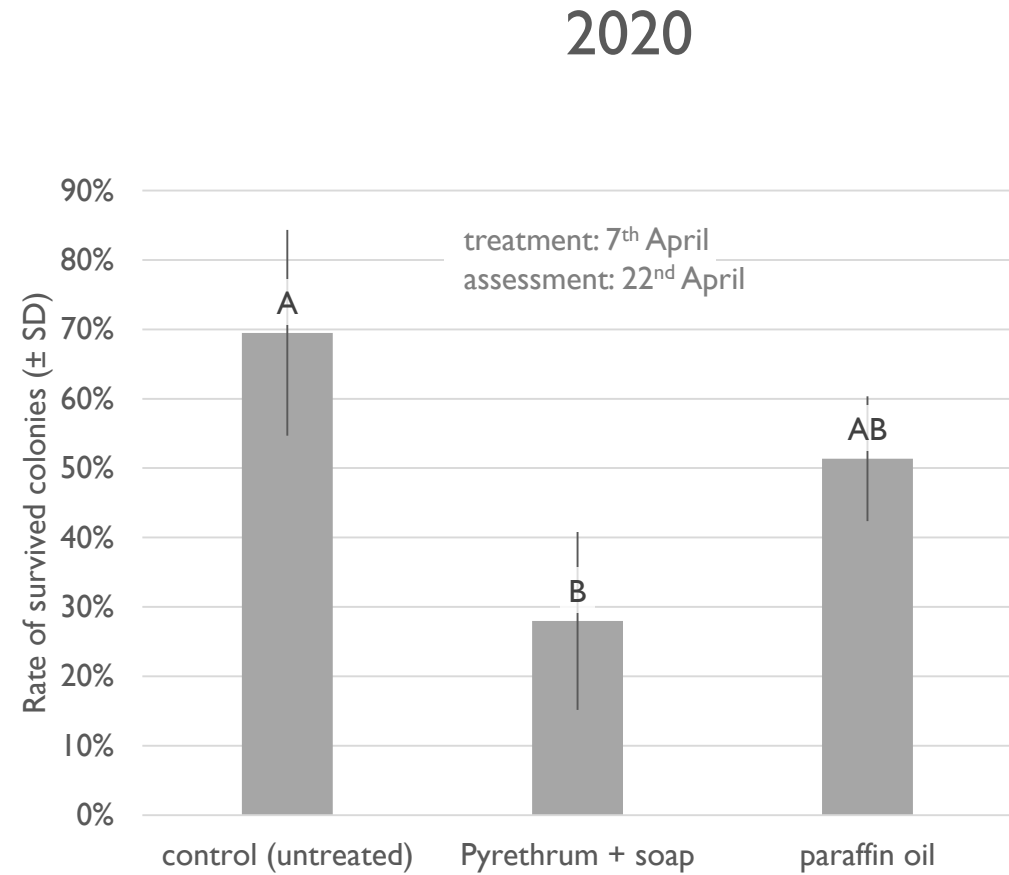
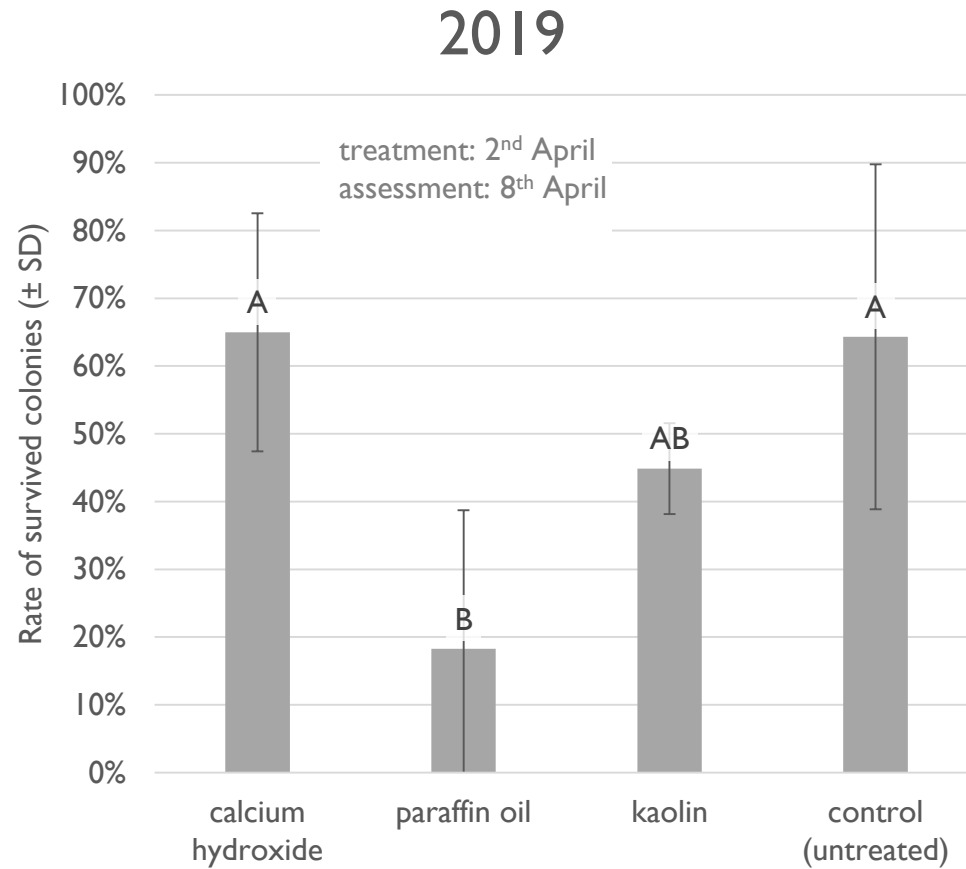
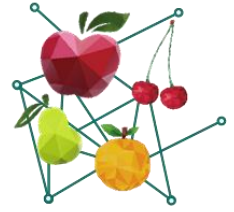
- For young trees very good effect with the two treatments «early» and «early + late»
- For older, voluminous trees only good effect with two applications in the treatment «early + late»
- Insufficient effect for older trees with only one application
- In the experiments 2019 and 2020 all treatments with paraffin oil showed an effect of 100 %.

Trial 2018 – pyrethrum + soap – results

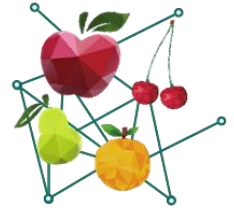


- Non-significant partial reduction of 82% on the young trees
- No effect on the older, voluminous trees

Trials 2019 & 2020 – results



Treatment in autumn – experimental design



- Treatment in autumn with kaolin (Surround ® WP)
- Prevention of the immigration and establishment of *Myzus cerasi*
 - Less fundatrices on cherry trees in the following spring
- Tested treatments:
 - kaolin: 3 x from the end of September 2019 until the leaves had fallen
 - paraffin oil in spring (11.03.2020)
 - combination of kaolin in autumn + paraffin oil in spring
 - untreated control
- Assessments:
 - Weekly monitoring (from 10.09.2020) of leaves for winged and unwinged aphid.
 - After the first kaolin treatment (27.09.2019) 50 leaves/tree assessed for winged and unwinged aphids and beneficial arthropods on 5 dates during October
 - 5 days after the paraffin oil treatment in spring, 20 bunches of buds/tree assessed for fundatrices and beneficial arthropods.
 - In summer (27.5.2020) 20 shoots/tree assessed for aphid colonies, symptoms of aphid damage and beneficial arthropods. A shoot was classified as infested or not and the number of curled leaves per shoot was counted.

Treatment in autumn – experimental design

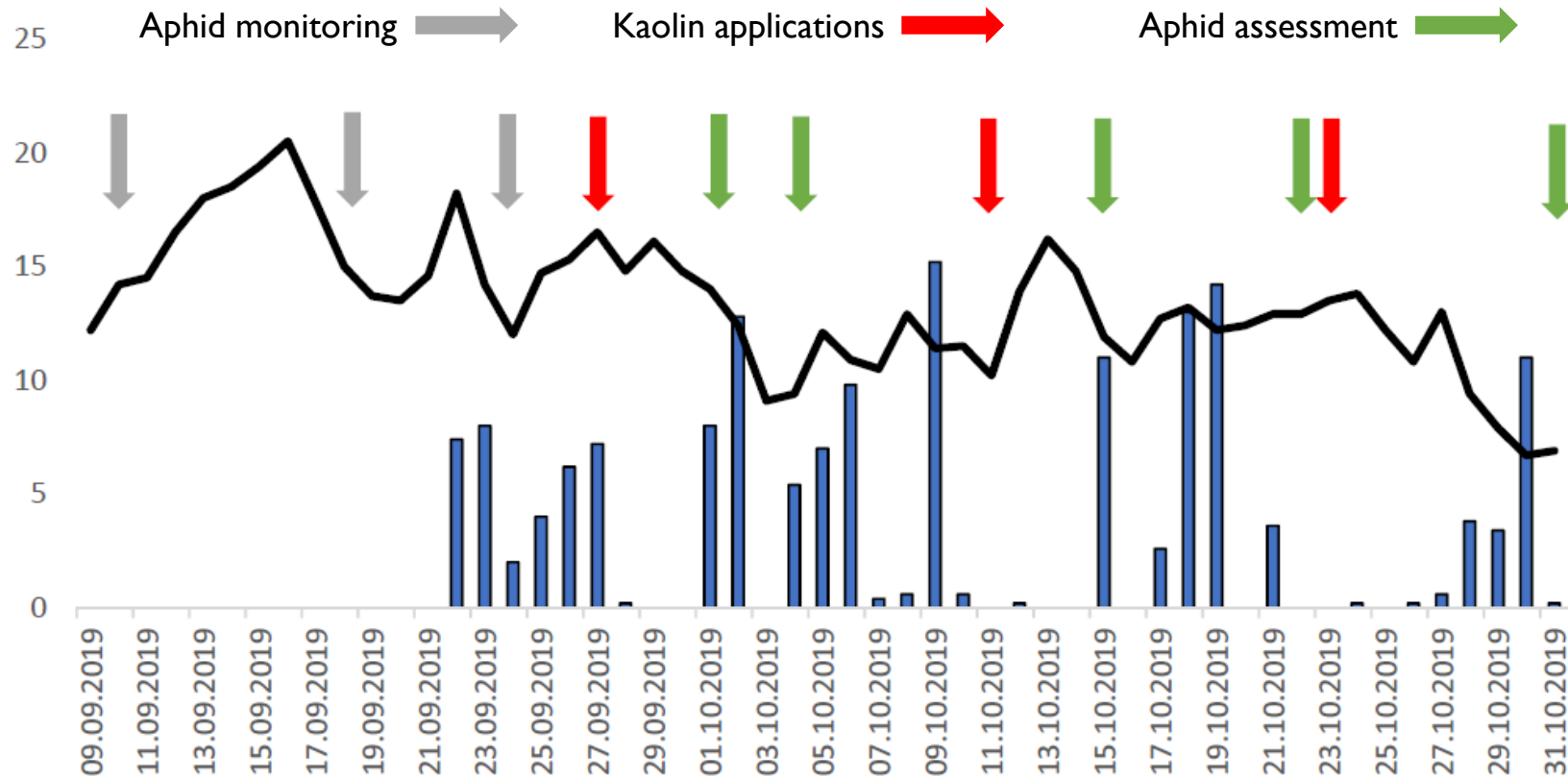
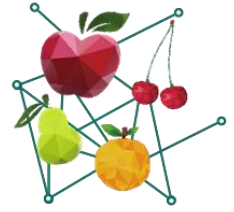
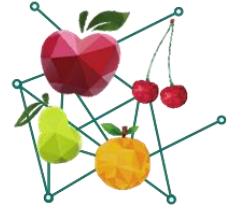


Figure 2: Mean temperature (°C, black line) and precipitation (mm, blue bars) in autumn 2019. Grey arrows indicate the aphid monitoring, green arrows show assessments of aphids after treatments and red arrows indicate kaolin applications.

Source: Cahenzli & Daniel (2020)

Treatment in autumn – mode of action of kaolin

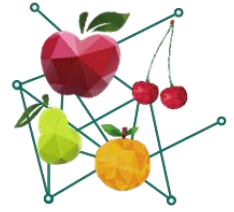


- Kaolin has different modes of action on aphids.
- The white residue alters light reflection, which could affect host detection and selection, since aphids response to colour and light.
- Furthermore, an accumulation of particle film on aphid body parts and especially on tarsi occurs, suggesting restricted aphid mobility and repellency. The particle film can even increase mortality and reduce oviposition.
- As a consequence, colonization of crops protected through kaolin by aphids is reduced.



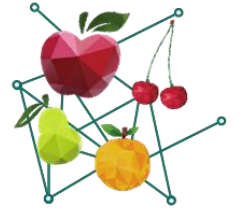
Figure 3: Wet leaves with invisible residue (left image). The white residue reappears after the leaves dry (right image).

Treatment in autumn – results



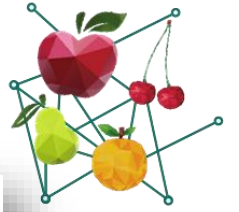
- After the first application of kaolin, there was no significant reduction in the number of winged or unwinged aphids.
- After the second application of kaolin until the end of the assessment period in autumn 2019, the number of immigrated, winged aphids was significantly lower on treated than untreated trees.
- Kaolin significantly reduced the number of winged and unwinged aphids in autumn despite wet weather conditions, which affected the white kaolin residues.
- The number of fundatrices in the following spring 2020 was significantly reduced by 95.27 %. Kaolin applied in autumn was significantly more efficient than paraffin oil applied in spring.
- Synergistic long-term effect of the combination of autumn kaolin treatments with spring oil treatment, which significantly reduced the proportion of infested shoots and the number of curled leaves until summer.

Direct regulation – conclusions

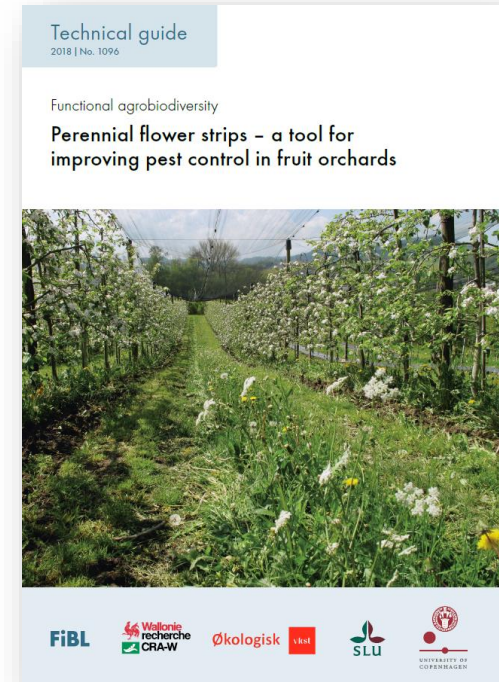


- Application technique (wetting) crucial for success!
- Paraffin oil at sprouting
 - Most important treatment → Reduction of fundatrices
 - With 2 treatments or already with 1 treatment up to 100 % effect
 - Effect still present after hatching of aphids
- Pyrethrum + soap
 - Treatments end of flowering before the leaves curl up
 - Very good application necessary (in 2 passes with high water volume)
 - Only with very good wetting (young trees) certain, but insufficient effect
- Neem (azadirachtin) preparations
 - 2-3 treatments from leaf development after flowering
 - Good effect with good application and slow aphid development
 - Insufficient effect on young trees and trees with strong growth
- Kaolin
 - Application in autumn can reduce the number of fundatrices in the following spring.

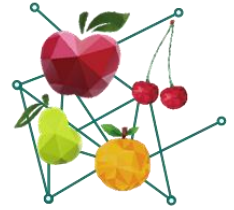
Indirect regulation of aphids in cherry orchards



- Flower strips in cherry orchards
 - Approach already applied in apple orchards
 - On-going trials on different farms in Switzerland
 - First experiences
 - Silting of the flower strips in the alley
 - Regeneration in October
 - Spider promotion observed
- Release of beneficial insects
- Open rearing of beneficial insects



Release of beneficial insects

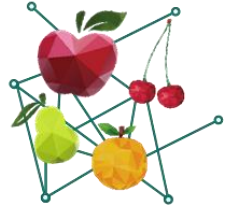


- **Green lacewing (*Chrysoperla carnea*)**
 - Application in suspended cardboard boxes
 - Placement directly in aphid colonies using a brush



→ no more larvae found during control

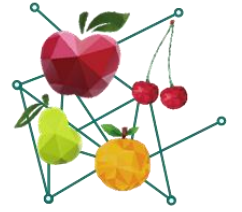
Release of beneficial insects



- **Aphid midge (*Aphidoletes aphidimyza*)**
 - Application in plastic trays on the floor
 - Application of counted adults
- no larvae found during control



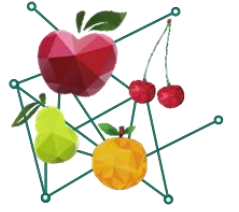
Release of beneficial insects



- **Hoverflies (*Episyrphus balteatus*)**
 - Application of pupae



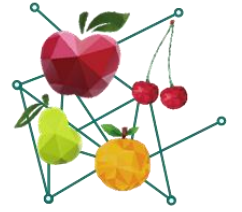
Release of beneficial insects – conclusions



- Release of hoverfly pupae at the end of April is too late, but hoverfly larvae are the most efficient antagonists of aphids.
- High density of naturally occurring hoverfly larvae

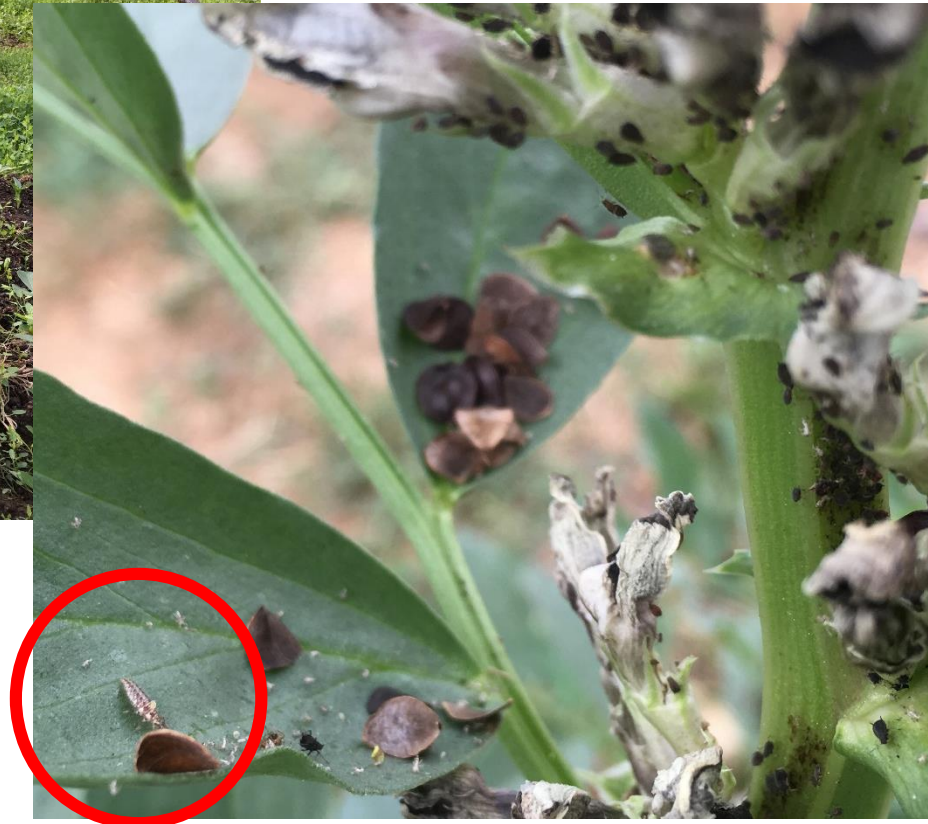
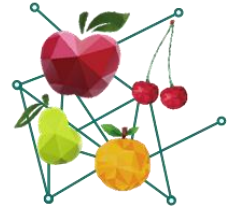


Open rearing of beneficial insects



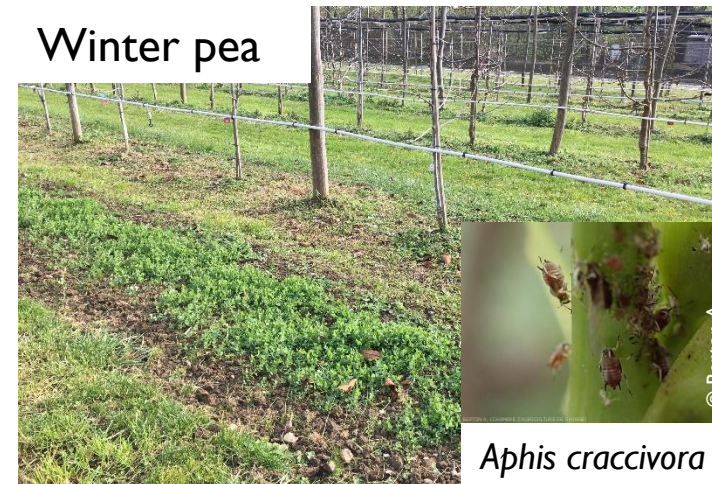
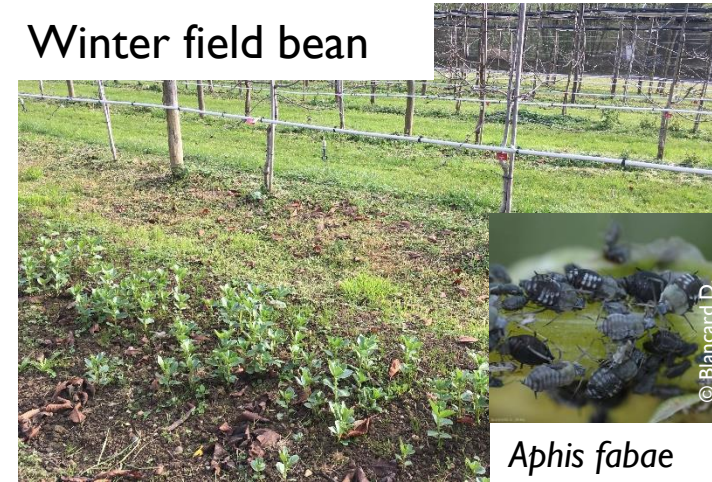
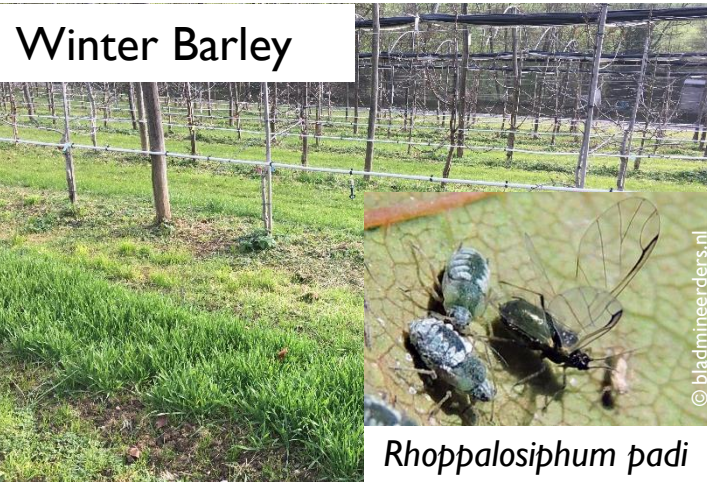
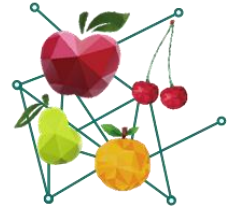
- **Objective:** early presence of beneficial insects for the regulation of black cherry aphids
- **Procedure:** cultivation of host plants for aphids, which serve as food source for beneficial insects.
- **Prerequisite:** aphids are host-specific and do not cause damage to the crop
- **Work steps:**
 - Establishment of the host plant
 - Application of host-specific aphids
 - Release of beneficial insects

Open rearing of beneficial insects – preliminary trials (in apricots)



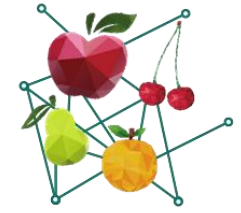
Application of *Chrysoperla carnea* was not successful

Open rearing of beneficial insects – trial 2021 in cherries



Overall conclusion

- There is not «the» solution
- Direct regulation
- Indirect regulation
 - Flower strips in cherry orchards
 - Release of beneficial insects
 - Open rearing of beneficial insects



→ We need to apply a combination of different approaches always adapted to the present situation (age of trees, pressure of pests, existing beneficials, ...)



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THANKS FOR YOUR ATTENTION!

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