CORE organic DOMINO

DELIVERABLE N. 5.2-5.5

DYNAMIC SOD MULCHING AND USE OF RECYCLED AMENDMENTS TO INCREASE BIODIVERSITY, RESILIENCE AND SUSTAINABILITY OF INTENSIVE ORGANIC FRUIT ORCHARDS AND VINEYARDS

YEARLY REPORT OF PLANT PHYSIOLOGICAL STATUS, CROPS' YIELD AND QUALITY DATA AS INFLUENCED BY OVERHEAD NETTING

(2019-2020)

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Work package 5 - New plant protection systems

The partners involved in WP5 are the Research Center Laimburg (LAIM) and the Research Institute of Organic Agriculture (FiBL). During 2018, the two partners discussed and defined the field trials and the goals of this work package, while the real field activities started in 2019, before the beginning of the vegetative season. The nets system was mounted on one apple tree row alternating ca. 15 meters covered by Keep in Touch® plots and ca. 15 meters not covered plots and was open during the phenological stadium BBCH 65. Until the nets opening, all the organic treatments performed in the three theses were identical. After the opening (roof nets + side nets) no more PPT were used in the covered and control thesis, while they were carried out as usual in the organic thesis. In June all the three theses were manually thinned leaving ca. 100 apples per tree. Main goals of WP 5: a) to understand if and how the Keep in touch system® (rain cover protective nets combined with sides anti-insect nets) is working in terms of fungal and pests damaging reduction, b) to understand if and how this system is influencing the harvest in terms of fruit production, c) to understand if the light quality/quantity changes due to the net presence affect the fruit quality.

Activities carried out at LAIM – 2019

Varieties: Gala. Four repetitions per treatment, 15 trees per repetition.

Experimental design:

1. (covered) thesis without PPT and with “Keep in Touch®” system
2. (control) thesis without PPT and without “Keep in Touch®” system
3. (organic) thesis with organic PPT and without “Keep in Touch®” system

During 2019 the system “Keep in touch” anti-acqua was mounted and opened as planned. In June all the three treatments were manually thinned and the first evaluation on fruits and leaves was performed. Within 48 hours after the harvest some of the fruits were destructively analyzed for macro- and micronutrients, TDS, pH, and acidity, while the rest was stored in a cold room (+4°C) for one week, until the visual evaluation. The fruits picked from five trees per repetition were first machinery sorted, to obtain data on fruit size, weight and color, then visually evaluated for all the main pest and disease damages. The apples classified as healthy were stored again until February 2020, until the

post-storage and shelf-life evaluations. During the vegetative season light measurements and data on photosynthetic activity inside and outside the Keep in touch were taken.

Dissemination activities

The results obtained during the season 2019 were presented to the European partners during the second-year meeting at the University of Hohenheim (November 2019), during the event "Series of lectures" occurred at the RC Laimburg (December 2019) and in Hohenheim at the Ecofruit conferences (February 2020). The results on KT obtained within the project DOMINO were analyzed with results obtained between 2016-2019 on other apple cultivars, other fruit trees and in the vineyard and published as short communication at Ecofruit 2020.

First results

On apple trees, the KT system allowed to reduce the plant protection products treatments carried out in 2019 without an increase in pest or fungal damages. In some cases, as for the pest damages (e.g. *Cydia pomonella*) the losses due to KT were sensible lower than in the organic sprayed plot. The chosen orchard was ideal to test such system as pests and diseases pressure was extremely high, as observed on the untreated control, where in September the primary scab infected 90% of the fruits, and the pest damages on the organic treated apples reached almost 50% of the apples. On the other hand, when the harvest is considered, the orchard is highly inhomogeneous and data on production (kg/tree) and fruit quality (size, weight, color) should be carefully considered. In order to avoid such problems data on fruit production and quality of 2020 will be collected in a different orchard where the same system is tested.

Light and photosynthesis measurements were carried out in three days, but it was not always possible to perfectly combine the availability of the team composed by professors, students and Laimburg workers with perfect sunny conditions. To reduce the variability caused by a few clouds and light mist the data were normalized with the frequent light measurements that were taken in the middle of the hallway at two meters height. Furthermore, the elevated number of measurements collected at different height and distance from the trunk takes time, and the amount of solar radiation naturally changed during the day. When absolute data are observed statistical differences were only a few and not always confirmed when the measurements were repeated during the season. Despite this, there are some trends that are evident, even when statistical analyses did not highlight them:

a) When light data are normalized with the external solar radiation in order to obtain the percentage of light increase/decrease, there is a clear reduction in the total light due to KT in the sun and shaded side, while the diffuse light increased in the first two meters of the sunny side and remains almost equal to the control in all the measures taken in the shaded side.

b) Neither in sunny nor in shaded side statistical differences were found in the photosynthesis measurement.

Significant differences were found in N and K content of the fruits, both higher in the KT treatment compared to the organic one, while Zn was significantly lower. The other macro- and micro- nutrients did not differ between these two treatments. No significant differences were found for what concern acidity, TDS (°Brix), pH and starch index, even if the last one showed lower values in the KT treatment.

Activities carried out at FiBL - 2019

Varieties: Ariwa and Topaz. Three repetitions per treatment, 5-11 trees per repetition.

Experimental design:

4. (covered) treatment without PPT and with "Keep in Touch®" system
5. (control) treatment without PPT and without "Keep in Touch®" system
6. (organic) treatment with organic PPT and without "Keep in Touch®" system

During 2019 the "Keep in touch" anti-acqua system was mounted and opened as planned at full bloom. At the end of April 2019 and end of August 2019 beating samples of the different treatments were performed to assess differences in the composition of arthropods. From each repetition, one sample was taken. The samples were sent for analysis to the project partner in Poland, but unfortunately, the composition of arthropods could not be assessed due to too many plant debris in the samples. In the middle of July 2019 the scab infestation of the leaves in the different treatments was assessed. Beginning of October, all fruits from five trees per repetition were harvested and visually assessed for pest and disease damages. Yield was assessed by weighing the fruits, which were classified into marketable fruits, fruits for cider production, and waste fruits. To assess fruit quality, fruit weight, firmness, and sugar content were measured and overcolor estimated for 10 fruits per repetition. Marketable fruits of the different treatments were stored in a cold storage at FiBL and storage damages on the fruits were assessed beginning of February 2020.

Dissemination activities

The results obtained during the season 2019 were presented in Hohenheim at the Ecofruit conference (February 2020).

First results

For both cultivars, scab infections were reduced in the “Keep in touch” compared to the “organic” treatment and even more compared to the “control”. However, scab infections were on a lower level for Topaz compared to Ariwa. The assessment of the fruits at harvest showed a decrease in the number of fallen fruits, rotten fruits on the tree, fruits with lenticel rot, fruits with sooty blotch, and fruits with insect feeding damage of the “Keep in touch” system. However, the amount of underdeveloped fruits, deformed fruits, and aphid damaged fruits was higher for the “Keep in touch system”. No fruit scab was found in any of the treatments. The yield and the share of marketable fruits was highest for the “Keep in touch” system, closely followed by the “organic” treatment, and lowest for the control. However, as at Laimburg, the orchard is highly inhomogeneous and data on production (kg/tree) and fruit quality (size, weight, color) should be carefully considered. Regarding fruit quality, fruit weight, sugar content, and the overcolor were lower for the “Keep in touch”, but no differences in firmness were found between the treatments. The post-storage evaluation revealed that less fungal diseases were found on fruits from the “Keep in touch” system compared to the “organic” treatment. Surprisingly the “organic” treatment had a higher share of rotten fruits than the control. However, due to a low yield and a few numbers of fruits especially for the “control” treatment, data for repetitions with less than ten fruits had to be discarded (half of the “control” repetitions), reducing the informative value of the remaining data.