Effect of cover crops on modern agricultural production of cherry trees in Chile

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Introduction

Plant covers have positive impacts on soil management by increasing the content of organic matter and nutrients, by improving the porosity and structure of the soil (Chen and Well, 2010), by increasing the moisture retention and biological activity (Frye and Blevins, 1989). They have also useful in weeds control due to the competitive effect (Ovalle et al., 2007). Then, another important effect of plant covers is on pest control, since its implementation favors the development and action of natural enemies (Ripa and Larral, 2008). This research project, entitled LivinGro™, is being developed in Chile jointly by Syngenta and Pontificia Universidad Católica de Chile. It aims to determine protocols for addressing the challenge of making modern agricultural production more sustainable by finding means to improve the condition of biodiversity and soil health in agricultural environment using ecological compensatory measures. Based on scientific data from field trials, this study monitors the effects of the use of plant covers in cherry orchards on soil parameters (physical, nutritional), soil microbiota, diseases, insects (beneficial and pests) and the possible impact on the quality and quantity of fruit produced.

Materials and Methods

Three experimental units established were established during June 2020 in three different commercial cherry fruit orchards in the Libertador Bernardo O'Higgins region (34°S 71°W). Data were collected on the area with cover crops and on an untreated area, further named 'control area', situated about 100 m in the same orchards. We evaluated the effect of covers crops on the nutritional characteristics of the soil, its microbiota, arthropods, pests and diseases and the possible impact on the quality and quantity of fruit in each orchard.

Figure 1. View of cherry orchards sown with cover crops in June 2020.

Cover crops

The establishment of the cover crops was monthly evaluated with 25x25 cm quadrant. The data indicate that covers did not achieve all the expected presence, being displaced by weeds present in the fields. Of the sown species, *Lolium* sp. stands out, which was present in the fields with greater frequency. Because of this, coverages will be re-sown in patches during the fall, in order to ensure and generate the desired cover crop density

Plant diseases

The presence, type and incidence of diseases affecting cherry plants, both at the wood and leaf level were periodically monitoring in the field from sprouting to postharvest. The focus was done on the main diseases affecting each orchard, focused on *Botrytis cinerea*, *Alternaria* sp. and *Pseudomona syringae* pv. *syringae*. Although the oldest orchards were already affected by certain wood diseases, these have no increase or greater relationship with the establishment of cover plants.

Figure 2. Disease monitoring in cherry trees.

Figure 3. Arthropod monitoring by net, Malaise and soil traps.

Arthropods and pests

To evaluate the abundance, the diversity of arthropods and its spread into the orchards, four different methodologies (visual monitoring, sweeping net, Malaise traps and soil traps) were regularly used into the cover plants and control areas. The pest populations keep low during all the season. The data from sweeping net did not show clear patterns. Malaise traps captured numerous Diptera and Hymenoptera species. Pitfall traps mainly captured Collembola in the springer, and Arachnida and Coleoptera. The underground traps mainly captured Collembola and Chilopoda.

Fruits

At harvestings, fruits were counted to estimate yield, fruit weight, size, color and estimated volume were recorded into the cover plants and control areas. Firmness, soluble solids, pH and acidity values were recorded in the laboratory. At the same time, samples were also stored in cold chambers (0°C), in order to detect the development of diseases 30 days after harvest. The results of the fruit measurements obtained in each orchards during this first year will serve as baseline values for the project.

Figure 4. Fruit analysis.

Conclusion

The preliminary results of the first experimental season, out of at least three, allow us to make **initial conclusions**. It seems **important to ensure cover plants domination over weeds present in the fields**, allowing to truly contrast sown areas with bare soil (untreated control) used yet in many fields in Chile. Soil results indicate a **high variability between the different fields** and it will allow us to obtain a **baseline for monitoring trough out years**. That variability corresponds to nutrition management made within fields (such as fertilization or amendments), and not to cover plants presence. In both, disease and insect sampling, neither shows clear trends regarding the effect of installation of cover plants. It seems of great importance to align experimental protocols with field practices and also to contrast them with environmental conditions. Finally, fruit analyses do not show positive or negative effect of cover plants, which is encouraging to continue monitoring for the following seasons.