Life - F3

Farm, Fresh fruit

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ENV/ES/000349

PROJETC DATA

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PROJECT BENEFICIARIES

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THE CONTEXT

According to the World Health Organization (WHO), low fruit and vegetable intake causes approximately 1.7 million deaths per year. At the same time, FAO 2021 studies predict serious fruit shortages up to 2050, with the world population reaching 9 billion, while **pests and diseases are responsible for up to 40 % yield loss** before harvest globally. Moreover, pesticide residues are a important food-related concern for EU citizens, and the European Food Safety Authority (EFSA) announced that more than 45 % of food products analysed (apples, head cabbage, lettuce, peaches, spinach, strawberries, tomatoes, barley, oats, wine grapes, swine fat, and milk) contain **pesticide residues.**

Thus, **reducing the use of pesticides in fruit production** is a major global environmental and societal challenge and it is in line with European Directive 2009/128/EC, demanding integrated pest management (IPM) as well as with 2016/2031/EC, which requires that a proportionate and effective response to plant health threats is established through a combination of technological, ecological and institutional management. Furthermore, the EU's **"Farm to Fork"** strategy within the Green Deal has set the goal of reducing the pesticides use by 50% by 2030. Still, pesticide overuse is wide spread and imprecise application causes serious **health problems, dangerous pest resistances, and considerable negative effects for biodiversity**, bee life, bystanders, and the ecosystem as a whole. Large parts of conventional spraying equipment are still highly inefficient. The size of the problem has been quantified in the three-year study Save Spray, directed by the Valencian Institute of Agriculture Research (IVIA), in collaboration with Fede, the University of Lleida, and the Polytechnical University of Catalonia (UPC)[1]. The study revealed **that 50% of plant protection product (PPP) do not reach the plants** but are lost due to drift, run-off, and ground losses when using conventional spraying equipment. As a result, a large number of pesticides are found in ambient air contaminating the environment.

Addressing this serious environmental problem, **Pulverizadores Fed S.L.U. (Fede)** led the EU LIFE Farm, Fresh Fruit **(Life-F3)** project to demonstrate, in partnership with the Spanish vineyard **Viñas del Vero SAU (Vero)** and the Portuguese olive plantation **Monte Do Outeiro Sociedade Agricola, S.A. (Outeiro)** which is part of Nutrifarms group, that **reduction of over 25% of pesticides and/or biocidal products is possible** simply through the correct use of Fede's existing spraying equipment together with good agronomic and farming practices while **maintaining adequate levels of efficacy** in pest and disease control.

In addition, the results show how Fede's technology **reduces the use of water and fuel**, thus diminishing the specialty crops protection environmental impact and positively contributing to the **climate resilience**.

1] Moltó E, Rosell, J R, Gil E, Salcedo R, Chueca P, Garcerá C. 2012 *Integrated Strategies for a save and efficient use of Phytosanitary Products*, Vida RURAL, vol. 353, Nov. 2012.

PESTICIDES REDUCTION THROUGH FEDE'S PRECISION SPRAYERS AND DIGITAL SOLUTIONS

The Life-F3 project demonstrates how Fede's smart sprayers and digital solutions reduce the drift and pesticides use by performing intelligent precision treatments in specialty crops. There are several technological building blocks that together compose the precision agricultural management system for specialty crops:

1. The technology used within the Life-F3 project includes a **high-end sprayer technology** known as Life-F3 sprayer (Figure 1) connected to the **Specialty Crops Platform (SCP)**, an **agronomic digital management tool**. With this equipment it is very easy to adapt the spray parameters precisely to the vegetation mass. Apart, the real time monitoring allows the tractor operator to visualize the work-in-progress on a user-friendly interface and to receive warnings in case of error in order to correct it right away thus avoiding proliferation of the pest/disease, which would entail the repetition of the treatment. All the data from the finished treatments is recorded and displayed to be analysed and provide real traceability. Also, all this data from the Life-F3 sprayer allows farmers to deliver a digital farm book with all relevant treatments data. This functionality helps the Life-F3 sprayer users to easily and automatically comply with the new regulations related to the compulsory digital farm book delivery.

Figure 1: Life-F3 sprayers with H3O technology.

2. **Specialty Crops Gateway (SCG)** installed in the tractor allows to monitor the tasks carried out with non-technological equipment. In addition, SCG devices are capable of connecting to Life-F3 sprayers, allowing data to be uploaded from the equipment in real time. Farmers and agronomic advisors have access to this data via web graphical user interfaces into the Specialty Crops Platform (SCP). This way, they can perform actions such us sending work orders to the sprayer operator as well as monitoring results. Moreover, through this interface, back office staff can post-process data. For example, as well as in the Life-F3 sprayer, SCG device helps to automatically fill the farm book in non-technological sprayers and other equipment and allows to obtain relevant data for farm management.

3. **Data collection**. To demonstrate that Fede's technology actually achieves the set environmental objectives, farming partners Vero and Outeiro monitored fuel, water, and pesticide consumption, as well as the quality of spray distribution in the canopy over the growing seasons 2020, 2021 and 2022 for the Life-F3 sprayer in comparison to an on-farm baseline grape harvester used to carry out phytosanitary treatments and a conventional sprayer respectively. With the aim to obtain comparable quality results the same work methodology was established at both farming partners:

Vero´s case, the tests were carried out in the specific area of their farm (Figure 2). The area has a surface of 16 ha and was planted in 2006 with of Chardonnay variety. These 16 ha were split into two equal parts for both types of sprayers. The conventional equipment worked in the blue area and the Life-F3 sprayer worked in the green area. Similarly, Outeiro carried out tests on 314 ha of olive varieties, Oliana and Arbequina. Plots were distributed so that the baseline sprayer and the Life-F3 sprayer worked on 157 ha each. Additionally, quality and quantity of fruit was analysed at each partner in order to demonstrate that savings achieved did not negatively affect the harvest amount nor the harvest quality.

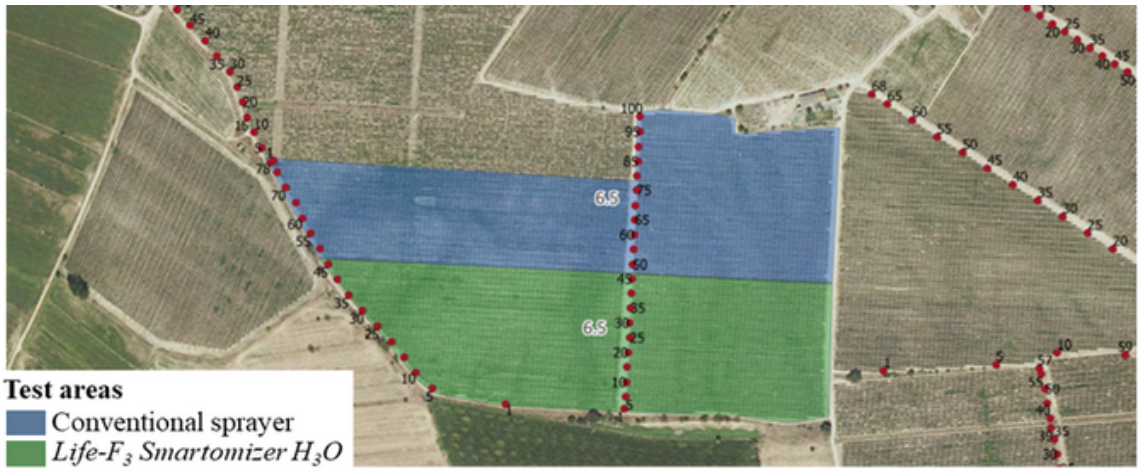

Figure 2: Vero´s test areas *(Berger et al. 2022).*

4. Operator training for effective execution of spray jobs. Another important asset is an online learning platform, Fede Academy (Figure 3), that contains presentations, handbooks, but most importantly, a fine selection of short video tutorials, guiding farmers, operators, and dealers through all necessary steps. Distance training and self-learning produced within Life-F3 and offered through the online learning platform Fede Academy gained special importance during the COVID-19 lockdown, when the displacements were strictly limited. This e-learning tool maximizes the Life-F3 knowledge and technology transfer. As such, specific online tailor-made training programs for farm owners, advisors, sprayer operators and distributors have been established, as proper usage and maintenance of the equipment is indeed absolutely essential to sustainably obtain agronomic input savings.

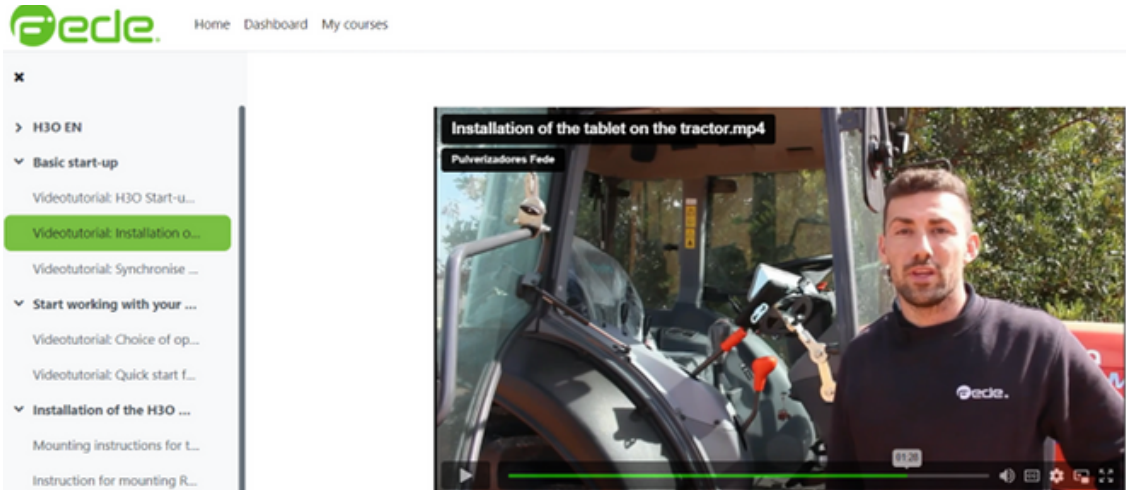

Figure 3: Fede Academy Online learning Platform.

RESULTS

The collected data confirm the significant environmental impact related to a decrease of the agronomic inputs used in each spraying task thanks to the use of H3O Life-F3 sprayer technology together with good agricultural practises. Vero demonstrated an average reduction of cost of treatments by 25% within the three years of the project. While the potential cost reduction of Outeiro is around 20%. Therefore, cost reductions are due to the fact that the Life-F3 sprayers make a more **efficient use of inputs in phytosanitary treatments while maintaining optimum levels of efficacy** in pest and disease control in each partner and location.

OUTEIRO

The speed of the treatment in specialty woody crops is one of the most important settings. Life-F3 sprayer has enabled to **increase the performance (ha/h) up to 27%** due to the possibility of increasing the forward speed from 7.5 to 9 km/h and better work efficiency index. This optimization has as a result the reduction of the amount of water, the number of tanks, as well as better manoeuvrability and refilling and mixing system. The fuel consumption of the tractor was the same for both sprayers (5 L/h), however, the increase of the performance has allowed to reduce the fuel to carry out the treatments, achieving savings up to 27%. Therefore, the efficient use of inputs such as fuel and water have a positive impact on the environment with a reduction up to 27% in greenhouse gases and up to 17,6% in water. Furthermore, the inputs reduction together with the field work optimization entails **a cost reduction of the treatment per hectare of around 20%.**

VERO

Regarding to the spray volume (L/ha) that was necessary to carry out the treatments, the Life-F3 sprayer allowed to **reduce spray volume by 25% in average**. Also, the water used per year (L) and its cost (€) was reduced by the same percentages and, a crucially relevant point is the fact that, the **PPP was dosed by water usage, making it possible to reduce it up to 25%**.

This result demonstrates that it is possible to reduce and adjust the spray volume to the requirements of the vineyard canopy using the Life-F3 sprayer and its H3O technology having a positive impact in the environment and increasing business' profitability by reducing the general cost of the treatments.

In addition to the positive impact on spray volume (water and PPP), Life-F3 sprayer has had a significant impact on work efficiency. Life-F3 sprayer has allowed to increase the performance of treatment (ha/h) by 11% due to the increase of the forward speed. Performance improvement enabled as well to reduce the fuel consumption and its cost by 50%, as Vero's baseline equipment registered a fuel consumption of 14-15l/h and the Life-F3 sprayer uses 7-8l/h. This reduction entails a diminution of the greenhouse gases related with the treatments by 50%. Based on the input reduction results (PPP, water, fuel, labour), it can be concluded that **the cost of the treatment per hectare was reduced by 25% on average**.

CONCLUSION

Innovative machinery and agronomic digital management solutions empower farmers to carry out effective and efficient treatments. The Life-F3 project demonstrates that significant plant protection product (PPP) and other **agronomic inputs savings can be achieved with available technology** such as Fede's Life-F3 sprayers and Specialty Crop Gateways (SCGs). These equipment and agronomic digital solutions together with good agricultural practices enable the transition to a more sustainable agricultural model, which contributes to climate resilience.

The adoption of technologies such as the Life-F3 sprayers and SCGs allow **decreasing the cost of treatments up to 25% while maintaining optimal pest and disease control**. Hence, Fede's technologies not just scale down agriculture's environmental impact determinedly but also help farmers to overcome productive, business and environmental hurdles.

The results of the field tests carried out within the Life-F3 project at Vero's and Outeiro's plantations show direct **environmental benefits** related to the spray volume reduction and the increase of the treatment efficiency (PPP, water and greenhouse gasses emissions decrease). Furthermore, the Life-F3 sprayers and SCGs involve a relevant **work management advancement** as well as **crucial public health assets** linked to the real traceability provided by this cloud-connected equipment.

Consequently, precision farming and digitalization are key to maintain harvest's quality and increase productivity for **farmers' profitability**, while facilitating **agriculture's evolution towards sustainability** through emissions reduction, biodiversity protection and food-security standards improvement.

ACKNOWLEDGEMENTS

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