Grupo Operativo PhytoDron:
“Phytodron” Innovation Project in Spain

8th May 2023

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Plazo de ejecución: 24 meses

Background| Precision Agriculture

- The European Green Deal and its Farm to Fork strategy includes, among other objectives, to reduce by 50% the use and risk of chemical pesticides by 2030
- European agricultural sector must reinvent itself to keep its productivity
- Technologies that balance economic and environmental sustainability are key

"Precision Agriculture is a management strategy that takes account of temporal and spatial variability to improve sustainability of agricultural production."

ISPA
International Society of Precision Agriculture

Application at the exact place/time

Resource Optimization

Variability management

Innovation & Sustainability

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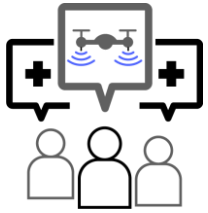
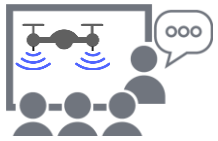
Problematic | Motivation

What motivated the creation of this Innovation **Project** GO Phytodron?

Legislative brake on technological progress aligned with sustainability: drone treatment is catalogued as aerial application, and therefore forbidden by the Sustainable Use Directive 2009/128/EC. Data is needed to advance the development of a new drone classification



There is great interest/**demand from the agricultural sector** (farmers, service companies, cooperatives) and businesses in determining a different category for these applications with UAVs and unlocking their use on a larger scale.



It was required to **provide data and examples of use scenarios** that demonstrate the difference with conventional aerial treatments and that support the safe use for both human health and the environment

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Problematic | Opportunities

Opportunities considered by the GO Phytodron

Scenarios

Applications in 2D and 3D crops (olive groves, vineyards, citrus) with products such as bait, band applications, forest masses with processionary, spot applications, on water surface (rice)...

Precision

Precise applications, at the proper time and place with the right amount of product. The aim was to optimize the efficiency of the application and improve its sustainability.

Safety

Potentially, these types of applications could improve farmers safety. Study of drift and deposition.

Innovation

The existing market for this type of applications brings a huge technical innovation, contributing to the agricultural development. It is necessary a proper development of new agro-technological profiles.

Accesibility

Being able to work in areas of difficult access: opportunity to treat crops on slopes or terraces and forestry crops

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GO Composition| Motivation

Why creating an Innovation **Project** ?

In order **to provide data and examples of relevant and different use scenarios**, a plural, multidisciplinary working group was required, distributed throughout the territory.

Funding was required to carry out the trials in different crops, conditions and geographies.

An Innovation Project is a **flexible tool** which allows the **demonstration** of new technologies and to provide the **new data** which could **support a regulatory change** to allow technological progress.

Representatives of academia, research institutes, growers and crop protection industry.

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“ GO Phytodron” Project:

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Co-funded by Spanish Ministry of Agriculture & European Agricultural Fund for Rural Development (EAFRD)

Professional Associations

aepla

Colegio Oficial de Ingenieros Agrónomos de Centro y Canarias

Farmers’ Associations

BaskEgur
ASOCIACIÓN DE LA MADERA DE EUSKADI

DCOOP

PTV PLATAFORMA TECNOLÓGICA DEL VINO

Universities

Universidad Politécnica Madrid

Universidad de Sevilla

Industry Companies

CORTEVA™ agriscience

BASF We create chemistry

syngenta

Research Institutes

CSIC Consejo Superior de Investigaciones Científicas

INIA Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria

NEIKER MEMBER OF BASQUE RESEARCH & TECHNOLOGY ALLIANCE

insst Instituto Nacional de Seguridad y Salud en el Trabajo

IRTA Institut de Recerca i Tecnologia Agroalimentàries

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GO Phytodron Objetives- Project

General

GO Phytodron aims to **advance** on the **regulatory framework** of **UASS** (Unmanned Aerial Spraying Systems) to be used as **precise and safe tool** for the spray application of Plant Protection Products (PPP)

Drift

Determine drift of UASS application

Exposure

Human dietary and non dietary exposure

Equipments

Technical characterization of UASS

Application

Quality, precision and efficiency of the application

Efficacy

Analysis of application effectiveness

Proposal

Proposal for regulatory change

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GO Objetives | Contributions

	Previous scenario	Scenario after GO
Exposure characterization	There are no experiences in measuring exposure to the operator/resident/bystander	First operator/resident/bystander exposure assessment comparing drone and terrestrial application
Drift	There are experiences but there is no standardized protocol.	**Protocol** to determine drift in different crops.
Equipments	There are no characterizations or approvals of UASS application (drones) for PPPs	First technical characterization of equipment and homogeneous criteria.
Application	There are some previous experiences on few crops regarding coverage, drops size...	Demonstration on **representative crops** and **first** experience **in forestry.**
Legislation	There is no consolidated initiative with data for a regulatory change.	First regulatory proposal based on real data.

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GO Phytodron Trials| Methodology

- Compare human and environmental exposure in UASS & conventional terrestrial and aerial spraying
- Characterization of operational scenarios in 3D and forestry crops to validate the hypothesis of the suitability to differentiate drone application from conventional aerial applications, through a multidisciplinary approach, developing different trials to evaluate application quality, non-dietary human exposure (OPEX, Resident, Bystander), Drift, Residues in crop and Efficacy of treatment.

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GO Phytodron Trials| Methodology

- Trials to evaluate:
  - Drift
  - Application quality
  - Non-dietary human exposure
  - Residues in crop
  - Efficacy

- Across Spain (climates & agriculture variability)

- Representative 3D crops (olives, citrus & grapevine) and forestry (pines)

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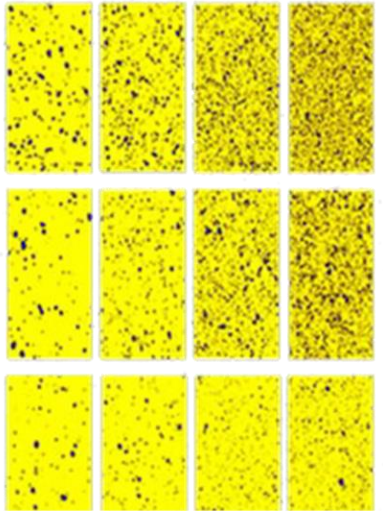
Drift Trials

- 14 trials conducted in vineyard, olive trees and pine trees to characterize aerial and sedimented drift using a tracer.
- The aim was to compare the sedimented drift curves obtained with UASS in GO Phytodron and standard drift values currently used in environmental risk assessment
- It is been demonstrated that following factors influence UASS drift:
  - crop
  - plantation framework
  - canopy
  - flight height
  - working width
- **UASS drift curve is between the FOCUS SW aerial and terrestrial standard drift curve.**
- Advancing on the characterization of UASS drift: more data are needed to complete experimental database and create UASS specific curves instead of standard manned aerial application (airplane/helicopter) curves for its evaluation under Reg. 1107/2009.



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Humans' non-dietary exposure trials

4 trials in grape vine were conducted comparing operator exposure (pilot and auxiliary activities[1]) and bystander and resident drift exposure during UASS application vs. conventional application (EFSA OPEX Guide[2])

[1] Mix and loading (M&L), purge, battery changes and maintenance and cleaning activities

[2] doi: 10.2903/j.efsa.2022.7032

Exposure	UASS & Conventional methods (EFSA OPEX Guidance)
Operator (auxiliary activities)	UASS > Operator (M&L; tractor, tank+lance and knapsack)
Operator (pilot)	UASS < Operator (Application; tractor, tank+lance and knapsack)
Bystander and Resident (drift exposure)	UASS < B&R drift exposure (high and low crops)

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Efficacy & Residue Trials

Citrus (mandarins) with incidence of *Ceratitis capitata* treated with a bait insecticide

4 replicates per trial: each replicate divided into 3 plots (control, conventional & drone treatment)

Results in terms of efficacy and residues are similar when applied the bait product with drone application and with terrestrial application (quad/tractor)

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Dron application| SWOT Analysis

WEAKNESSES

- Currently prohibited and limited to PPPs authorized for aerial treatment.
- Absence of specific evaluation models for drones
- Weight > 25 kg special authorization
- Limited battery autonomy
- Not suitable for PPPs that need total coverage or reaching dropping point

STRENGTHS

- Precision Agriculture (bait, patch and pheromones): efficiency and residues equivalent to terrestrial application
Environmental: zero fuel, water, zero soil compaction
- Difficult Applications (waterlogged soil and complex orography)
- Repeatability

THREATS

- Gradual decline in PPPs authorized for aerial treatment
- UASS treatments Bad practice results in poor results, questioning its usefulness
    - not choosing a suitable combination crop-PPP-pest
    - applicator without agronomic or PPPs spraying knowledge
    - poor calibration of the spray system
- Limit drone application to ULV limits full expansion: it would be better to evaluate PPPs under UASS specific best practices

OPPORTUNITIES

- Contribute to meet sustainability goals
- Improvement of social perception of phytosanitary treatments
- Digital transformation of the agroforestry sector is key to attract talent, boost countryside economy and maintain EU agriculture's competitiveness.

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Final considerations:

- Characterization of **exposure in terrestrial applications is different** from that of UASS Spraying
- Characterization of **exposure in manned aircraft aerial treatment is different** from UASS Spraying because:
  - Drones can work with variable application height and different forward speed
  - Drones can use smaller water volumes and work with another type of nozzle configuration
  - Drones can be applied with Drones can perform targeted and localized applications
- UASS treatment is not equivalent to conventional manned aerial treatment
  - ✓ Completely different behavior between drone and manned aircraft treatment: therefore, evaluation must be different
  - ✓ Similar case: backpack treatment has a different evaluation than tractor treatment, and both are terrestrial treatment
- Urgent need:
  - ✓ Development of specific scenarios to estimate exposure for UASS treatments
  - ✓ Characterize conditions under which drones are the right tool for reaching sustainability objectives
  - ✓ Define scenarios for UASS use: treatment types, crops and proper PPPs
- With today's technology, spraying with UASS is highly suitable for specific scenarios :
  - ✓ Bait, patches and pheromone applications
  - ✓ 3D crops in continuous rows such as super-intensive olives or vineyards and fruit trees grown as hedgerows
  - ✓ 2D crops such as rice

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Conclusions:

- **Encouraging results:** drones are valid tools for precision agriculture that contribute to meeting sustainability goals, while addressing farmers requirements and needs.
- **Success:** a holistic, realistic and pragmatic study has proven that treatment with drones is different to manned aerial treatment, speeding up EU processes towards its approval
- **Next steps:**
  - EU to regulate drone application as Precision Agriculture in future Sustainable Use Regulation
  - Generate more data to define UASS application behavior
  - Continue working to develop exposure scenarios in a specific assessment for drones at EU level
  - Creation of working groups including Member States, EFSA, EU Commission, Growers and PPPs and Machinery Industry

We are closer to making the use of drones in precision agriculture a reality

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Questions?

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