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DELIVERABLE

Traps placement study

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Executive Summary

The aim of the deliverable is to provide all necessary information related to the traps used for monitoring enemies within the scope of the LIFE GAIA Sense project. To start with, a theoretical background about the type, use and placement of traps is provided. Following, for each Use Cases, a detailed analysis of the type of enemies, their main characteristics, the rationale behind defining the location of the traps as well as the kind of traps and how they are monitored, is presented.

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Definitions, Acronyms and Abbreviations

Acronym	Title
CE	Circular Economy
GAIA	GAIA EPICHEIREIN ANONYMI ETAIREIA PSIFIAKON YPIRESION
NP	NEUROPUBLIC AE PLIROFORIKIS & EPIKOINONION
SF	Smart Farming
COSTEIRA	VIÑA COSTEIRA SCG
MIRABELLO	Agricultural Cooperative Partnership Mirabello Union S.A.
VELVENTOS	Agrotikos Synetairismos Epexergasias kai Poliseos Oporokipeftikon Proionton (ASEPOP) Velventou SYN.P.E
CONFAGRI	Confederação Nacional das Cooperativas Agrícolas e do Crédito Agrícola de Portugal CCRL
ORESTIADA	Enosi Agrotikon Synetairismon Orestiadas
AIGINA	Omada Pagagogon Kelyfotou Fistikiou Aiginas
ELASSONA	Agrotikos Synetairismos Kelyfoton Elassonas
LASITHI	Enosi Agrotikon Synetairismon Oropediou Lasithiou
SPEKO-PESKO	Enosi Agrotikon Synetairismon SPEKO-PESKO
KIATO	Geoponiki Kiatou
STYLIDA	Stylis Olive Producers Cooperative
THESTO	Agricultural Cooperative of Thessalian Tomato Producers
THESGI	Farmers' Cooperative of Thessaly

1. Introduction

1.1. Project Summary

The main objective of the LIFE GAIA Sense project is to demonstrate gaiasense, an innovative "Smart Farming" (SF) solution that aims at reducing the consumption of natural resources, as a way to protect the environment and support Circular Economy (CE) models.

More specifically, this project will launch 18 demonstrators across Greece, Spain and Portugal covering 9 crops (olives, peaches, cotton, pistachio, potatoes, table tomatoes, industrial tomatoes, grapes, kiwi, walnut) in various terrain and microclimatic conditions. They will demonstrate an innovative method, based on high-end technology, which is suitable for being replicated and will be accessible and affordable to Farmers either as individuals or collectively through Agricultural Cooperatives.

Moreover, LIFE GAIA Sense aims to promote resource efficiency practices in SMEs of the agricultural sector and eventually, contribute to the implementation of the Roadmap to a Resource Efficient Europe. This project will demonstrate a method on how the farmer will be able to decide either to use or avoid inputs (irrigation, fertilizers, pesticides etc.) in a most efficient way, without risking the annual production. The focus is on the resource consumption reduction side of CE, and the results will be both qualitatively and quantitatively, considering the resources' efficiency in agricultural sector.

1.2. Document Scope

It is generally accepted that both the costs and the quality are the most important elements in the production of agricultural products. One of the main goals of the project is to introduce smart farming practices to support farmers maintaining these at desired levels (reduced cost, increased quality) through the proper crop management.

One of the many aspect of the project is pest management and particularly the implementation of an intelligent smart farming system that will inform the farmer about the danger of the appearance of the enemies and diseases.

For each Use Case, a number of targeted enemies[1] has been identified through the cooperation of the farmers and NP. In order to monitor the population of the enemies and combine it with data from the telemetric stations a traps placement study is completed for each Use Case. The study includes a brief description of the targeted enemies, the type of traps and the methodology for deploying the traps.

[1] The terms pest and enemy are synonymous and are used interchangeably in this document

2. Traps placement study - Summary

The traps placement study is part of a wider design of the way of dealing with enemies in different crops which basic principle is the definition and use of Tolerance Density Limits (POPs) of populations of the harmful enemies, at which control measures have to be taken.

Placement and monitoring of traps is a very valuable source of information for developing the scientific models for pest management.

This placement study for each Use Case includes:

- information about the targeted enemies
- Information about the types of traps to be used
- Information about the methodology of deploying and monitoring the traps

The use of traps facilitates the monitoring of insect or arthropods /enemies population in different crops. In some cases, traps are also used as an environmental friendly alternative to pesticides when it comes to pest management. Their main use though is to examine the distribution of enemies' occurrences during the cultivation period.

Different kind of enemies are lured by different attractants. For instance, flies and wasps are attracted by proteins, tephritis flies are attracted by methyl eugenol, other insects by colors, fragrances, pheromones, lactic acid etc. That has resulted in a great number of different types of traps with the most commonly used attractants being:

- Food (non-specific using attractive liquids)
- Light (affecting vision on some species)
- Colour (water and adhesive)
- Sound (effect on hearing)
- Mechanical (e.g. soil Pitfall)
- Suction (with the influence of wind non-selective)
- Shelter traps (eg tape with arcades around logs for captive larval arrests)
- Egg traps (using attractive nesting)

Within the scope of the project, the most commonly used traps are

McPhail traps

The McPhail traps (Figure 1) are marketed in many variations and are usually plastic with a yellow bottom and transparent top. In some cases i.e. when used by governmental agencies for monitoring Dacus in Greece (olive fruit fly), McPhail glass traps are used.

An aqueous 2% phosphate or ammonium sulfate solution is used and in some experimental cases hydrolyzed protein solution of 4% and 1.5% borax. Certain formulations such as NuLure have proven to be particularly attractive for the olive fruit fly although they are not widely used.

Figure 1: Trap type McPhail

Delta

Delta traps (Figure 2) are named after their Delta-form shape. An adhesive surface is placed at the base of each trap and is replaced according to the number and frequency of insect trapping. On each trap stand, a sex pheromone evaporator is placed attracting certain sex of the enemies. The pheromone is replaced about every 3 weeks, except in cases of high temperatures when there is a need to replace them earlier.

Figure 2: Delta type Pheromone Adhesive Trap

Figure 3: Funnel pheromone trap

Funnel trap

Funnel traps (Figure 3) are using a sex pheromone evaporator for attracting the enemies i.e green worm. Impregnated sheets of paper with the active insecticide transfluthrin (0.4% w / w), each weighing 0.325 g, are placed inside the trap in order to extinguish the captured enemies. The impregnated sheets have to be replaced twice a month.

Depending on the type of traps, their use, the insect to be monitored, and the crop, traps are placed in accordance with the following common instructions:

1. The installation usually takes place at the beginning of the growing season.
2. The traps have to be assembled carefully and in accordance with the manufacturer's instructions.
3. In pheromone traps the change of pheromone should be done every 3 weeks except in cases of very high temperatures or rainfall when it may be needed to replace them earlier.
4. In cases where new trapped insects are counted, if the trap type allows it, trapped insects should be removed after each measurement.
5. Adhesive traps should be checked regularly so that there is a sufficient "adhesive" surface to ensure high trapping efficiency. Whenever necessary they should be replaced with new ones.
6. In traps using an attractive solution (e.g. McPhail type for trapping) the proportions of the solution have to be kept at a stable level and the attractant should be renewed at regular intervals.

In ORESTIADA, four enemies have been identified for cotton that are targeted at this project (Table 1).

Table 1: Enemies identified and traps used for ORESTIADA

Crop	Type of pest/disease	Name	Type of trap
cotton	Enemy	*Helicoverpa armigera*	Funnel trap
		Pectinophora gossypiella	Delta trap
		Eurygaster maura	Not used
		Lygus hesperus	Not used

In VELVENTOS, one enemy has been identified for peach that is targeted at this project (Table 2).

Table 2: Enemy identified and trap used for VELVENTOS

Crop	Type of pest/disease	Name	Type of trap
peach	Enemy	*Grapholita molesta*	Delta trap

In ELASSONA, one enemy has been identified for walnut (Table 3)

Table 3: Enemy identified and trap used for ELASSONA

Crop	Type of pest/disease	Name	Type of trap
walnut	Enemy	*Cydia pomonella*	Delta trap

In LASITHI, two enemies have been identified for potato that are targeted in this project (Table 4)

Table 4: Enemies identified and traps used for LASITHI

crop	Type of pest/disease	Name	Type of trap
potato	Enemy	*Leptinotarsa decemlineata*	Not used
		Phthorimaea operculella	Delta trap

In SPEKO-PESKO, two enemies have been identified for kiwi (Table 5).

Table 5: Enemies identified and traps used for SPEKO-PESKO

crop	Type of pest/disease	Name	Type of trap
kiwi	Enemy	*Pseudaulacapsis pentagona*	Yellow sticky traps
		Metcalfa pruinosa	Not used

In KIATO, one enemy has been identified for table tomato (Table 6).

Table 6: Enemy identified and trap used for KIATO

Crop	Type of pest/disease	Name	Type of trap

Table tomato	Enemy	*Helicoverpa armigera*	Funnel Trap

In STYLIDA, two enemies have been identified for table olives (Table 7).

Table 7: Enemies identified and trap used for STYLIDA

crop	Type of pest/disease	Name	Type of trap
Table olives	Enemy	*Bactrocera oleae*	McPhail
		Prays oleae	Delta pheromone

In THESTO, one enemy has been identified for industrial tomato (Table 8).

Table 8: Enemy identified and trap used for THESTO

Crop	Type of pest/disease	Name	Type of trap
Industrial tomato	Enemy	*Helicoverpa armigera*	Funnel Trap

In THESGI, four enemies have been identified for cotton (Table 9).

Table 9: Enemies identified and traps used for THESGI

Crop	Type of pest/disease	Name	Funnel trap
cotton	Enemy	*Helicoverpa armigera*	Delta trap
		Pectinophora gossypiella	Not used
		Bemisia tabaci	Not used
		Lygus hesperus	Funnel trap

In MIRABELLO, two enemies have been identified for olives (Table 10).

Table 10: Enemies identified and traps used for MIRABELLO

crop	Type of pest/disease	Name	Type of trap
olive	Enemy	*Bactrocera oleae*	McPhail
		Prays oleae	Delta trap

In COSTEIRA, one enemy has been identified for grape (Table 11)

Table 11: Enemies identified and trap used for COSTEIRA

crop	Type of pest/disease	Name	Type of trap
grape	Enemy	*Lobesia botrana*	Delta trap

In CONFAGRI, one enemy has been identified for olives (Table 12)

Table 12: Enemies identified and trap used for CONFAGRI

crop	Type of pest/disease	Name	Type of trap
olive	Enemy	*Prays oleae*	Delta trap

APPENDIX I

Pests for each Use Case

Use Case	Crop	Pests
ORESTIADA	cotton	*Helicoverpa armigera*
		Pectinophora gossypiella
		Eurygaster maura
		Lygus hesperus
VELVENTOS	peach	*Grapholita molesta*
ELASSONA	walnut	*Cydia pomonella*
LASITHI	potato	*Leptinotarsa decemlineata*
		Phthorimaea operculela
SPEKO-PESKO	kiwi	*Pseudaulacapsis pentagona*
		Metcalfa pruinosa
KIATO	table tomato	*Helicoverpa armigera*
STYLIDA	table olive	*Bactrocera oleae*
		Prays oleae
THESTO	Industrial tomato	*Helicoverpa armigera*
THESGI	cotton	*Helicoverpa armigera*
		Pectinophora gossypiella
		Bemisia tabaci
		Lygus hesperus
MIRABELLO	olive	*Bactocera oleae*
		Prays oleae
COSTEIRA	grape	*Lobesia botrana*
CONFAGRI	olive	*Prays oleae*