Deliverable number: D5.3

Deliverable title: BROCHURE TO FARMERS ON IPM GUIDELINES, BEST TECHNOLOGIES AND USE

EC version : 2.1

<table>
<thead>
<tr>
<th>Due date of deliverable</th>
<th>14/01/2019 (M40)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Actual submission date</td>
<td>28/01/2020</td>
</tr>
</tbody>
</table>
# DOCUMENT INFO

## 1. Author(s)

<table>
<thead>
<tr>
<th>Organisation name lead contractor</th>
<th>VIU</th>
</tr>
</thead>
</table>

### Author

<table>
<thead>
<tr>
<th>Author</th>
<th>Organisation</th>
<th>e-mail</th>
</tr>
</thead>
<tbody>
<tr>
<td>P. Delval, ACTA</td>
<td>ACTA</td>
<td><a href="mailto:philippe.delval@acta.asso.fr">philippe.delval@acta.asso.fr</a></td>
</tr>
<tr>
<td>A. Fornetti, VIU</td>
<td>VIU</td>
<td><a href="mailto:alessandra.fornetti@univiu.org">alessandra.fornetti@univiu.org</a></td>
</tr>
<tr>
<td>I. Mannino, VIU</td>
<td>VIU</td>
<td><a href="mailto:ilda.mannino@univiu.org">ilda.mannino@univiu.org</a></td>
</tr>
</tbody>
</table>

## 2. Revision history

<table>
<thead>
<tr>
<th>Version</th>
<th>Date</th>
<th>Modified by</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>04.02.2019</td>
<td>P. Delval, ACTA</td>
<td>Starting version</td>
</tr>
<tr>
<td>0.2</td>
<td>20.02.2019</td>
<td>A. Fornetti, I. Mannino, VIU</td>
<td>Revisions</td>
</tr>
<tr>
<td>0.3</td>
<td>21.02.2019</td>
<td>P. Delval, ACTA</td>
<td>Revisions</td>
</tr>
<tr>
<td>0.4</td>
<td>27.02.2019</td>
<td>A. Fornetti, I. Mannino, VIU</td>
<td>Complete draft</td>
</tr>
<tr>
<td>0.5</td>
<td>20.03.2019</td>
<td>INRA</td>
<td>Approval of complete draft</td>
</tr>
<tr>
<td>1</td>
<td>12.04.2019</td>
<td>INRA</td>
<td>Approval from EU to submit as confidential</td>
</tr>
<tr>
<td>1.1</td>
<td>09.01.2020</td>
<td>A. Fornetti, I. Mannino, VIU</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>28.01.2020</td>
<td>INRA</td>
<td>Submitted as public</td>
</tr>
<tr>
<td>2.1</td>
<td>25.04.2020</td>
<td>A. Fornetti, I. Mannino, VIU, P. Delval, ACTA, M. Pugliese, ANT, G. Gilardi, AGRO, R. Albajes, S. Planas, UdL, J. Arnó, IRTA, INRA</td>
<td>Updated according to the reviewer comments</td>
</tr>
</tbody>
</table>

## 3. Dissemination level

<table>
<thead>
<tr>
<th>PU</th>
<th>Public</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>CO</td>
<td>Confidential, only for members of the consortium (excluding the Commission Services)</td>
<td>☑</td>
</tr>
</tbody>
</table>

Note: the Final draft of the Brochure will be PUBLIC.
### EXECUTIVE SUMMARY

<table>
<thead>
<tr>
<th>Background</th>
<th>Task T5.1 – Dissemination to farmers. The Brochure is part of EUCLID dissemination strategy towards EU and Chinese farmers, in order to transfer to them the IPM Packages developed and hence increase the impact of the project.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objectives</td>
<td>The brochure is made to instruct farmers on IPM practices and on the best approach to use and exploit the pest management and IPM packages developed in EUCLID project.</td>
</tr>
<tr>
<td>Methods</td>
<td>Farmers, both European and Chinese, are key beneficiaries of EUCLID project: the Brochure is therefore conceived as to further support the training activities carried out in WP4 “demonstration” and hence effectively transfer the methodology developed in EUCLID to the farmers. The Brochure aims at raising the awareness of farmers on IPM, to instruct them on the use of EUCLID IPM packages, pointing out the advantages in using IPM. The Brochure was edited in April 2019 as first draft including the results of the 2018 demo trials and residue analyses and presented at the final conference of the project in September 2019 to collect feedback form the stakeholders. On the basis of the feedback collected and on the results of the analyses carried out in 2019, the final draft has been be edited at the end of the project, when all demo trials and residue analysis were completed both in Europe and in China.</td>
</tr>
</tbody>
</table>
## Results & implications

The Brochure allows an active and efficient dissemination about the project and its key results (i.e. IPM Packages) both to European and Chinese farmers.

The main implication is the adoption of the IPM Packages by EU and Chinese farmers as primary end-users of EUCLID research.

Overall implication is to support the dissemination of sustainable production methodologies, in order to secure food production and human health while reducing economic losses.
# Table of contents

Introduction............................................................................................................................................. 6

1. BROCHURE FOR FARMERS ON IPM GUIDELINES, BEST TECHNOLOGIES AND USE .............. 7
   1.1. What is IPM?.................................................................................................................................. 8
   1.2. IPM packages ............................................................................................................................. 9
   1.3. Demonstration trials and Residues analyses ............................................................................. 10
   1.4. Positive results from testing and demo trials .......................................................................... 11
Introduction

Farmers, both European and Chinese, are key beneficiaries of EUCLID project.

As such, the **D5.3 - BROCHURE TO FARMERS ON IPM GUIDELINES, BEST TECHNOLOGIES AND USE** is conceived with the objective of

(i) raising awareness of farmers on IPM;
(ii) instruct European and Chinese farmers on the methods and tools developed by the project.

In particular, the Brochure wants to disseminate the IPM Packages tested and developed in EUCLID project, thus offering a ready-to-use tool for farmers.

With these objectives in mind, the Brochure is structured as to raise awareness of European and Chinese farmers on:

- IPM,
- the findings of EUCLID project,
- the needs for developing a sustainable agriculture,
- the advantages that IPM can bring to farmers and to society at large.

The Brochure contains:

- explanation of the concept of IPM, including the social, environmental and economic advantages from the farmers’ perspective,
- the principles of the most successful IPM methods proven to be effective in EUCLID project, to foster their uptake by European and Chinese farmers,
- useful contacts to support farmers in the adoption of IPM for the main countries producing the crops of interest for EUCLID.

The brochure is meant to be distributed directly to farmers by EUCLID partners through events and/or farm visits they will host and/or in which they will take part and/or organize, also after the end of the project. It will also be available in the project website and be distributed in relevant platforms of the partners (including social media platforms), networks and events focusing on IPM or similar.

In order to widely reach farmers, the brochure is edited in five languages: English, French, Italian, Spanish and Chinese.
To the same end, the brochures are available in printed version or can be downloaded from the web.

The different sections of the brochure in English are reported below as screenshots of the original one.
1. BROCHURE FOR FARMERS ON IPM GUIDELINES, BEST TECHNOLOGIES AND USE
1.1. What is IPM?

What is IPM?
The implementation of Integrated Pest Management (IPM) is now a European regulatory obligation dictated by the European directive 2009/128 and sometimes by specific legislation in various member states, such as France, which has enshrined it in law. Integrated Pest Management is not the equivalent of Good Plant Protection Practices which provide the basis for the proper and appropriate use of plant protection products (PPPs), but takes a sustainable approach to plant protection further.

This approach is based on the combination of biological, mechanical, cultural and chemical control methods, to grow healthy crops and minimize the use of pesticides. The final goal of IPM is to maintain pest damage at economically acceptable levels while protecting the environment and human health.

The logic of integrated protection is no longer “a problem = a solution” but “to prevent problems as much as possible and to intervene properly with no chemical solutions if possible”. To quote the 2009/128 Directive (Point 16): “...low risk pesticides as well as biological measures should be considered in the first place.”

The diagram below – Figure 1 – translates this logic:

- Put the cultivated plant in the best conditions allowing it to limit the aggressions: It includes the choice of varieties, any agronomic or cultural measures favoring crops and disadvantaging pests
- Follow up to know the plant health situation: it is very important to know the effectiveness of the measures initially taken as a function of the pest and disease pressure. As non-chemical methods are preferred, early action is required to ensure the effectiveness of these alternative methods
- React by prioritizing non-chemical methods
- Keep records to better understand successes and failures.

![Diagram representing the logic proposed by EUCLID for IPM implementation](image)

Alternative methods include all available biological, mechanical or physical techniques. Chemical methods will be resorted to only when strictly necessary. Decision rules, which include strategies related to anti-pesticide resistance, require a good knowledge of the phytosanitary situation.
1.2. IPM packages

**IPM Packages**

EUCLID considers IPM to be a combination of measures, as promoted by the International Organization for Biological and Integrated Control (www.iobc-wprs.org/ipm/IoBC_IP_principles.html). Consequently, the research work has focused on the assembly of the different IPM methodologies analyzed, which are grouped into IPM packages.

EUCLID delivers the simultaneous optimisation of current pest management methods and the development of novel ones, to promote their rapid adoption and use by end-users through IPM packages. The objective is to reduce the dependence of farmers on chemical pesticides in selected key farming systems, ensuring increased product quality and a lower environmental impact.

EUCLID aims to improve the performance of management measures for a diverse set of pests and pathogens in three important crops (grapes, leafy vegetables and tomatoes). A total of 280 established and novel pest management measures are considered for inclusion in the IPM packages to control up to 26 pest/pathogens across these crops.

IPM packages consist of 3 Excel-based packages (one for each crop), in which agronomical, chemical and biological strategies are suggested and integrated with novel solutions developed by EUCLID. Indications on the limits of use of chemical pesticides are also considered. (www.euclidipm.org/ipm - QR Code 1)

IPM packages were tested on the three crops in partners’ facilities in three EU countries (France, Italy, Spain) and in China, on the three crops. Field visits were organized during the demonstration days. Information on field visits are available on the EUCLID website. (www.euclidipm.org/field - QR Code 2)

EUCLID also provides an Excel-based tool to assess innovative pest management measures in the context of newly-designed IPM packages for commercial field conditions and with a view to reducing dependence on chemical pesticides. Each package is evaluated using 6 performance indicators: Reduction of losses, Human health, Direct costs, Environmental Impacts, Time & management, and Scale & independence.

To read more about the tool please refer to EUCLID website (www.euclidipm.org/tool - QR Code 3).

**TO READ MORE PLEASE SCAN QR CODE**

QR CODE 1  
QR CODE 2  
QR CODE 3
1.3. Demonstration trials and Residues analyses

Demonstration Trials and residues Analyses

EUCLID tested and validated the designed IPM packages through field trials. These trials offered the opportunity to compare one or more growing programs containing EUCLID innovations with a conventional program using mainly pesticides or current IPM practices. These new solutions to manage pests and diseases are mainly biocontrol solutions and Decision Support System tools. During the two years of field trials (2018 and 2019), 28 demonstration trials have tested the IPM packages on the 3 crops. These trials focused on pests and diseases of tomato, lettuce and grapes.

During the demonstration days, numerous exchanges with advisors and growers allowed the EUCLID experimenters to gather data and feedback that helped to perfect the project proposals.
In addition, analyses of pesticide residues were carried out on tomatoes, lettuce and grapevines. Research activities and results from these trials led to the design of the final IPM packages.
1.4. Positive results from testing and demo trials

Positive Results from testing and demo trials

CROP: LEAFY VEGETABLES
DEMO COUNTRY: FRANCE, SPAIN, ITALY

<table>
<thead>
<tr>
<th>TARGET PEST/DISEASE</th>
<th>EFFECTIVE EUCLID PEST MANAGEMENT APPROACHES/PACKAGE</th>
<th>SUGGESTIONS</th>
<th>RESIDUE ANALYSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sclerotinia rot and Botrytis gray mould</td>
<td>Binab PG5 at soil preparation, ANT's compost at soil preparation, Mach 1 during crop development</td>
<td>IPM programs with the combination of soil treatments (Binab PG5 or ANT Compost with or without Trichoderma) and Mach 1 proved to be effective. Use of varieties with lower levels of susceptibility may be a complementary approach. Another recommendation to better control Sclerotinia rot is to improve natural ventilation of the tunnels, further adjust irrigation to reduce air humidity, remove diseased plants upon detection of symptoms and apply soil treatment with EUCLID innovations.</td>
<td>The IPM Euclid programs decreased or eliminated the detection of residues in the lettuce heads in all trials. All residues quantities found in the IPM and conventional programs were always under the Maximum Residues Levels.</td>
</tr>
<tr>
<td>(France - Spain)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fusarium wilt and Rhizoctonia crown rot</td>
<td>Binab PG5 in nursery BCA's in nursery, ANT's compost in nursery</td>
<td>The combination of nursery treatments with plant resistance inducers, soil amendments and biocontrol agents for the management of the Fusarium wilt of lettuce caused by Race 1 of Fusarium oxysporum f.sp. lactucae proved their interest. The early application of BCAs and ANT's compost in nursery is carried out at a more localized level, with reduced amounts of products compared to the application in the field. Temperature is a key factor to ensure efficacy of compost and BCAs and it should be managed all throughout tunnels or greenhouses; we get better effects using EUCLID innovations when starting from the nursery. These innovations should be easily combined with genetic resistance measures (cultivars tolerant to Fusarium wilt), helping to reduce the pathogen pressure and to prevent the break of the resistance.</td>
<td></td>
</tr>
<tr>
<td>(Italy)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

CONTACTS: ANT + AGROINNOVA + INRA + IRTA + BINAB

EUCLID - Europe-China Lever for IPM Demonstration
info@euclidipm.org.com - www.euclidipm.org
### Positive Results from testing and demo trials

**CROP:** TOMATO  
**DEMO COUNTRY:** ITALY, FRANCE, SPAIN, CHINA

<table>
<thead>
<tr>
<th>TARGET PEST/DISEASE</th>
<th>EFFECTIVE EUCLID PEST MANAGEMENT APPROACHES/PACKAGE</th>
<th>SUGGESTIONS</th>
<th>RESIDUE ANALYSES</th>
</tr>
</thead>
</table>
| Fusarium wilt (Rhizoctonia crown rot  
Phytophthora crown rot) | BCA’s in nursery  
ANT’s compost in nursery | Preventative nursery application of biocontrol agents and compost (ANT’s compost) and Binab PGS as separate treatments induced a significant reduction in Fusarium wilt and on the pathogen abundance. The BCAs and compost treatments did not induce a negative effect on the non-target microbial communities. | The IPM Euclid programs decreased or eliminated the detection of residues on the tomato fruits in all trials.  
All residues quantities found in the IPM and conventional programs were under the Maximum Residues Levels. |
| Grey mould | ANT-Ca | Applied as a foliar spray, EUCLID innovation showed protective effect of pruning wounds against Xeroyces cinereus. | |
| Powdery mildew | Binab Air  
ANT-Ca | Different EUCLID programs with partners' products (Binab Air, ANT-Ca) have the tendency to reduce the attack of powdery mildew on tomato.  
This trend was observed in 2018 and confirmed in 2019, with an additional significant effect against Alternaria spots for ANT-Ca. | |
| Tuta absoluta  
Whiteflies | Dioryctis sp. (bollivari, errans)  
ANT-Ca  
Encarsia formosa | Considering the high numbers of naturally colonizing Microplitis pygmaea in many Mediterranean greenhouses, the pre-planting inoculation of Dioryctis sp. does not seem necessary at low pest densities. However, early establishment of Dioryctis nymphs might be useful in case of high pest pressure soon after the transplant.  
Proper management of the predators would be necessary to minimize risks due to its phytophagy.  
We can observe a significantly higher efficiency of two parasitoid releases (Encarsia formosa) in the reduction of whitefly population and further economic gains.  
In Italy, Ant-Ca significantly reduced Tuta absoluta leaf mines on tomato cv. Griffon when combined with the different IPM programs with mate disruption systems as compared to the untreated control. | |

**CONTACTS:** ANT + AGROINNOVA + INRA + IRTA + AGROBIO + BINAB
### Positive Results from testing and demo trials

**CROP:** GRAPEVINE  
**DEMO COUNTRY:** ITALY, FRANCE, SPAIN

<table>
<thead>
<tr>
<th>TARGET PEST/DISEASE</th>
<th>EFFECTIVE EUCLID PEST MANAGEMENT APPROACHES/PACKAGE</th>
<th>SUGGESTIONS</th>
<th>RESIDUE ANALYSES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Downy mildew</td>
<td>ANT-Ca</td>
<td>It is possible to control the disease in case of low pressure. In case of high pressure of downy mildew, it is recommended to associate the EUCLID innovation with other specific fungicides.</td>
<td>Except for copper, the levels of residues were lower in EUCLID-IPM programs than in conventional IPM ones. The reduction of doses of mineral compounds (sulphur, copper) with DOSA3D did not reduce the level of residues. In all cases residues were below the LMR values.</td>
</tr>
<tr>
<td>Powdery mildew</td>
<td>ANT-Ca</td>
<td>The results, confirmed in 2019, showed a disease reduction comparable to conventional treatments on leaves and on berries.</td>
<td></td>
</tr>
<tr>
<td>Yellow mites, downy mildew, powdery mildew</td>
<td>DOSA3D - A decision support tool developed by the University of Liénea, based on pesticide rate reduction regarding the foliar area of the grapevine, has also been tested on Spanish grapevines to improve applications of fungicides and acaricides. The dose adjusted with the tool showed that the total amount of applied pesticides could be reduced keeping at a similar level the efficacy of the treatments.</td>
<td>Advisers and growers identified several difficulties to establish the correct doses for chemical control of grape pests and diseases including yellow mite (Eotetranychus carpinus), downy mildew (Plasmopara viticola) and powdery mildew (Uncinula necator). This tool allows it, not only on grapevine, but on different fruit tree production.</td>
<td></td>
</tr>
</tbody>
</table>

**DOSA3D system is available in six languages:** Spanish, Catalan, English, French, Italian and Chinese in the website: dosa3d.cat/en

**CONTACTS:** ANT + ACTA + IFV + UDL

**ANTs** > compost suppressive compost rich in beneficial microorganisms developed by project partner ANT  
**ANTs Ca** > liquid based formulation rich in calcium developed by project partner ANT  
**BCAs** > Biological Control Agents  
**Biabir Air** > product to tackle aerial diseases produced by Biabir partner  
**Mach 1** > biological control agent developed by project partner ANT  
**PGS** > Plant growth substance
EUCLID is an R&I Action funded by the EU Commission under Horizon 2020.

The overall objective is to secure food production for the increasing worldwide population while developing sustainable production methodologies to fight pests with an Integrated Pest Management approach (IPM), to be used in European and Chinese agriculture.

EUCLID research activity aims to develop more sustainable pest management methods in Europe and China in order to reduce the negative effects of pesticides on human health and the environment, to reduce economic losses in agriculture, and to provide scientific support to EU and China policies.

info@euclidipm.org    www.euclidipm.org

CONTACT INFO for IPM Packages and products

ACTA, France: philippe.delval@acta.asso.fr
AGROBIÓ, Spain: evila@agrobio.es
AGROINNOVA, Italy: giovanna.giardi@unito.it
ANT, Italy: ceo@agrinewtech.com
BINAB, Sweden: thomas.ricard@binab.se
IFV, France: david.lafond@vignevin.com
INRA PACA, France: philippe.nicot@inra.fr
IRTA, Spain: judit.armo@irta.cat
UDL, Spain: santiago.planas@udl.cat

This project has received funding from the European Union’s Horizon 2020 research and innovation programme under grant agreement No 633999
Cover of the brochure in Chinese, French, Italian and Spanish.