# BROCHURE FOR FARMERS AND ADVISORS ON IPM GUIDELINES, BEST TECHNOLOGIES AND USE

EUCLID

Europe China Lever for IPM Demonstration

# 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 a 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.

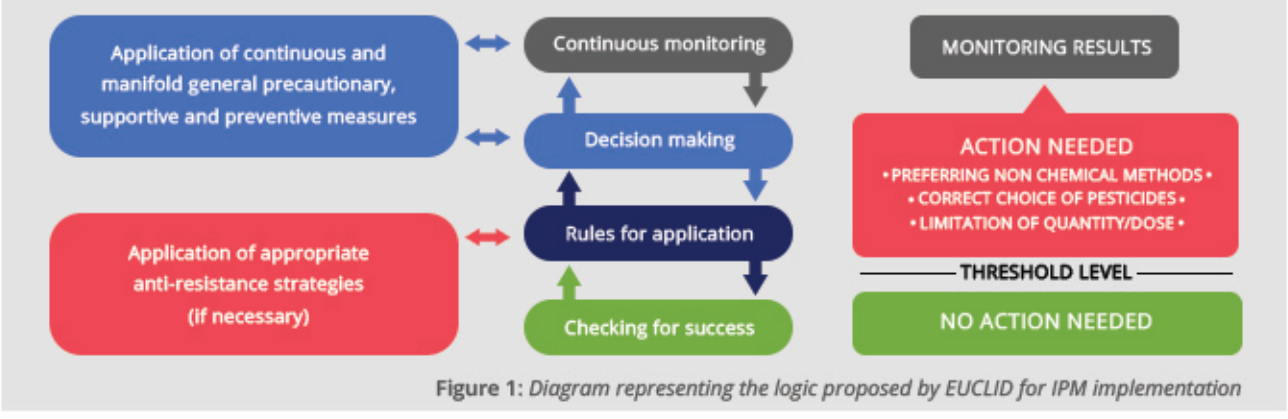



**Figure 1:** *Diagram representing the logic proposed by EUCLID for IPM implementation*

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.

# 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/ip_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.

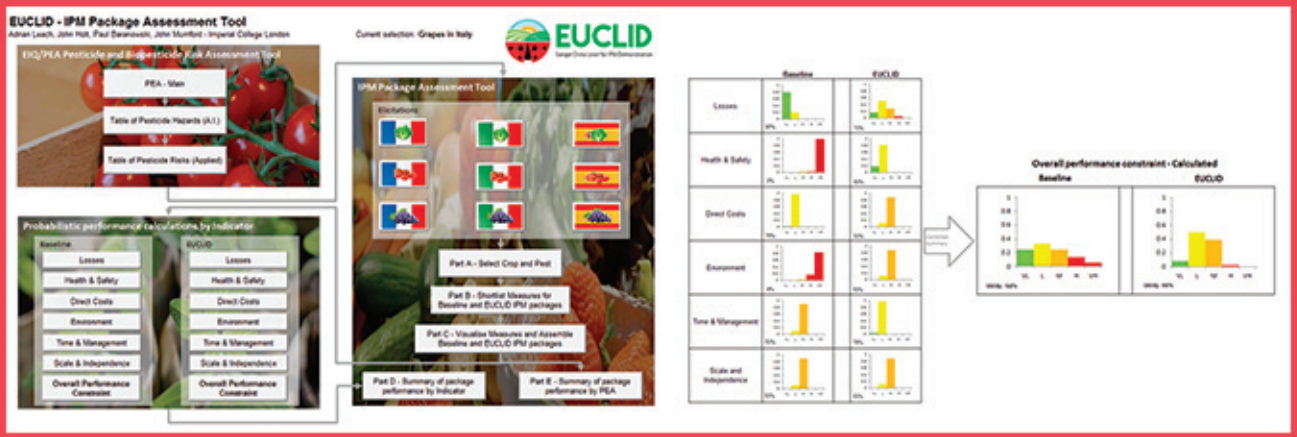
EUCLID delivers the simultaneous optimisation of current pest management methods and the development of novel ones, to promote their rapid adoption and use by end-users through **IPM packages**. The objective is to reduce the dependence of farmers on chemical pesticides in selected key farming systems,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

## 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.

*Lettuce demonstration trial in Italy*

*Tomato demonstration trial in Spain*

During the demonstrations 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**.

## Positive Results from testing and demo trials

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

| TARGET PEST/DISEASE | EFFECTIVE EUCLID PEST MANAGEMENT APPROACHES/PACKAGE | SUGGESTIONS | RESIDUE ANALYSES |
|---|---|---|---|
| Sclerotinia rot and Botrytis gray mould (France - Spain) | Binab PGS at soil preparation<br>ANT's compost at soil preparation<br>Mach 1 during crop development | IPM programs with the combination of soil treatments (Binab PGS 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.<br>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. | The IPM Euclid programs decreased or eliminated the detection of residues in the lettuce heads in all trials.<br><br>All residues quantities found in the IPM and conventional programs were always under the Maximum Residues Levels |
| Fusarium wilt and Rhizoctonia crown rot (Italy) | Binab PGS in nursery<br>BCA's in nursery<br>ANT's compost in nursery | 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. | |

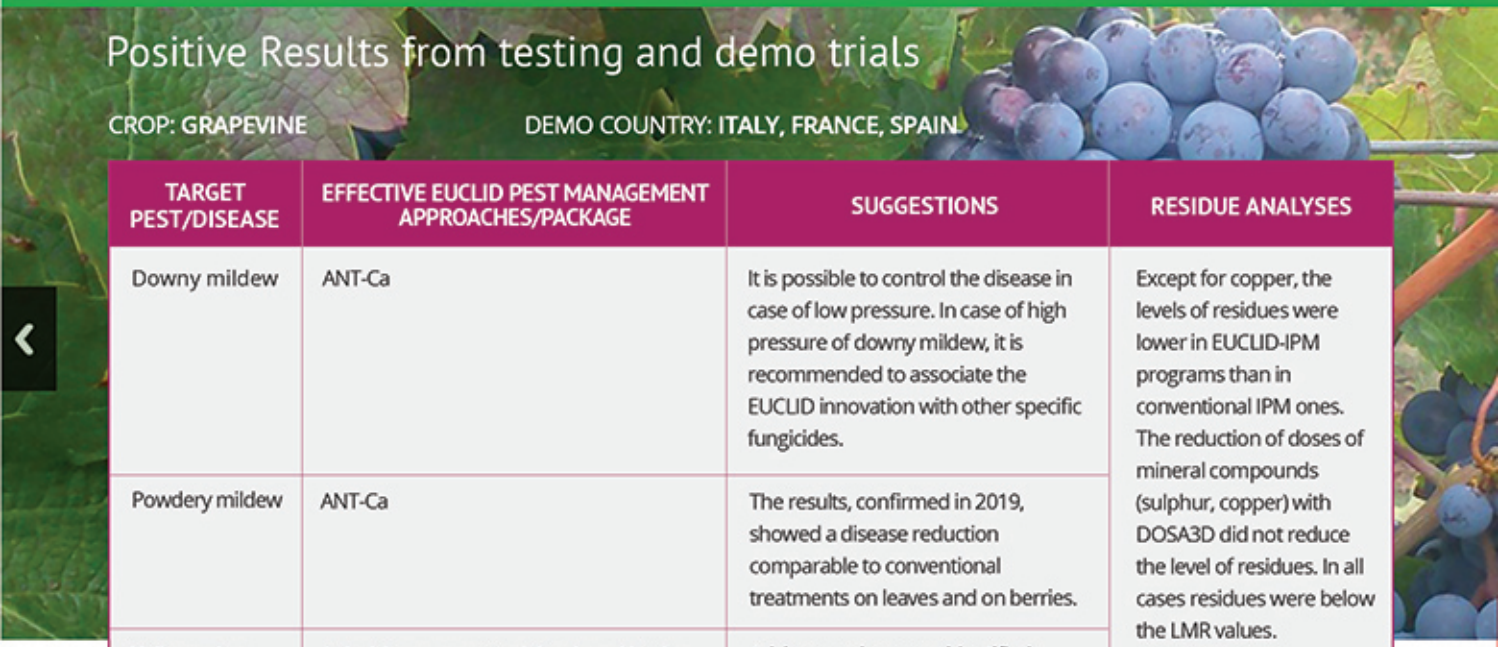
**CONTACTS:** ANT + AGROINNOVA + INRA + IRTA + BINAB

# Positive Results from testing and demo trials

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

| TARGET PEST/DISEASE | EFFECTIVE EUCLID PEST MANAGEMENT APPROACHES/PACKAGE | SUGGESTIONS | RESIDUE ANALYSES |
|---|---|---|---|
| Fusarium wilt (Rhizoctonia crown rot Phytophthora crown rot) | BCA's in nursery<br>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.<br><br>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 *Botrytis cinerea*. | |
| Powdery mildew | Binab Air<br>ANT-Ca | Different EUCLID programs with partners' products (Binab Air, ANT-Ca) have the tendency to reduce the attack of powdery mildew on tomato.<br>This trend was observed in 2018 and confirmed in 2019, with an additional significant effect against Alternaria spots for ANT-Ca. | |
| *Tuta absoluta*<br>Whiteflies | *Dicyphus sp.* (*bolivari, errans*)<br>ANT-Ca<br>*Encarsia formosa* | Considering the high numbers of naturally colonizing *Macrolophus pygmaeus* in many Mediterranean greenhouses, the pre-planting inoculation of *Dicyphus sp.* does not seem necessary at low pest densities. However, early establishment of *Dicyphus* nymphs might be useful in case of high pest pressure soon after the transplant.<br>Proper management of the predators would be necessary to minimize risks due to its phytophagy.<br>We can observe a significantly higher efficiency of two parasitoid releases (*Encarsia formosa*) in the reduction of whitefly population and further economic gains.<br>In Italy, Ant-Ca significantly reduced *Tuta absoluta* leaf mines on tomato cv. Grifone 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**

| TARGET PEST/DISEASE | EFFECTIVE EUCLID PEST MANAGEMENT APPROACHES/PACKAGE | SUGGESTIONS | RESIDUE ANALYSES |
|---|---|---|---|
| Downy mildew | ANT-Ca | 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. | 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. |
| Powdery mildew | ANT-Ca | The results, confirmed in 2019, showed a disease reduction comparable to conventional treatments on leaves and on berries. | |
| Yellow mites, downy mildew, powdery mildew | A decision support tool developed by the University of Lleida (DOSA3D), 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.<br><br>DOSA3D system is allowable in six languages: Spanish, Catalan, English, French, Italian and Chinese. | Advisers and growers identified several difficulties to establish the correct doses for chemical control of grape pests and diseases including yellow mite (*Eotetranychus carpini*), downy mildew (*Plasmopara viticola*) and powdery mildew (*Uncinula necator*). This tool allows it, not only on grapevine, but on different fruit tree production (**dosa3d.cat/en**). The system allows setting the optimal spray volume and dose rates, taking into account the following factors: crop dimension, pest to be controlled and spraying efficiency. The adapted dose with the tool shows that the total amount of pesticides in grapes could be reduced. | |

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

**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 develope 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.

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