

EVERGREEN

"ENVIRONMENTALLY FRIENDLY BIOMOLECULES FROM AGRICULTURAL WASTES AS
SUBSTITUTES OF PESTICIDES FOR PLANTS DISEASES CONTROL"

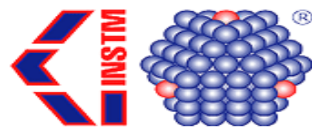


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THE PARTNER



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The project called LIFE13/ENV/IT 000461 LIFE EVERGREEN

AFTER LIFE Communication Plan



EVERGREEN RESULTS

EVERGREEN demonstrated *in vitro* and *in vivo* efficacy and reliability of the polyphenolic-based biomolecules extracted from agricultural non-food biomasses and wastes as disease control products against phytopathogenic bacteria and nematodes, for replacing current commercial pesticides and application of copper salts in conventional and organic agriculture.

Optimised field treatments were carried out on several plants and crops having a high commercial value and here used as a model (Olive, Kiwi, Potato, Tobacco).

In particular, the project obtained the following environmental results:

Green chemistry extraction of high quality and standardised polyphenolic fractions and molecules from not edible vegetable biomass/waste of chestnut, olive, artichoke and grapevine, and process optimization at laboratory scale

The EVERGREEN polyphenolic fractions and molecules are biologically and chemically stable, using water as the most performing and ecofriendly solvent, as demonstrated at laboratory level

The EVERGREEN high quality polyphenolic extracts are active against plant pathogenic bacteria and nematodes *in planta* at laboratory scale, using concentrations in the range 1-100µM, as demonstrated by traditional pathogenicity assay and molecular tests

The *in planta* biological activity of the EVERGREEN high quality polyphenolic extracts is comparable to that of copper-based and traditional nematicides

The EVERGREEN high quality polyphenolic extracts do not possess any toxicity on organisms and microorganisms commonly used for acute and chronic toxicity tests, and on universally conserved subcellular targets such as Ca²⁺-ATPase

The EVERGREEN high quality polyphenolic extracts do not cause any direct selection towards the emergence of bacteria resistant to the polyphenolic molecules themselves, as well as any cross-selection of copper- and antibiotic-resistant bacteria

The Kilo-scale green extraction of the EVERGREEN polyphenolic fractions and molecules recovered from vegetable not edible biomass/waste was optimised

The EVERGREEN polyphenolic extracts are active in plant protection against phytopathogenic Gram negative bacteria and nematodes, as demonstrated by 4 optimised formulations on model systems at pilot and field screening, with beneficial effects on soil microflora

The spent vegetable biomass, at the end of the extraction of the EVERGREEN standardised polyphenolic fractions/molecules, can be recycled for energetic purposes and as fertilizers, as demonstrated for chestnut tannin, olive pomace and grape marc

The EVERGREEN approach is an ecofriendly and sustainable solution in plant protection in the frame of circular economy, as demonstrated by the LCA carried out on the processes concerning the most active EVERGREEN formulations

The above defined environmental results were obtained by the project through:

- the demonstration of the negative environmental impact of the use of conventional chemical pesticides for the control of bacterial and nematode diseases of plants.
- the demonstration of the performances as plant disease control products of the polyphenolic-based molecules extracted from agricultural vegetable wastes, at laboratory, pilot and field scale.
- the demonstration of the efficiency of tailored formulations of these polyphenolic-based molecules as plant disease control products, to achieve the highest activity on the different plant pathogens.

Activity	Responsible	Resources	Duration after the project end
Diffusion of 2,000 video and multimedia material during special events, workshops, direct visits, meetings and email	All beneficiaries	Own resources around € 3,000	5 years
CEBASCSIC will carry out new different experiments to laboratory and greenhouse scale to know the EVERGREEN result efficiency	CEBASCSIC	Own resources Around € 5,000	2 year
New contacts with stakeholder in Spain. CEBAS-CSIC will carry out new contacts with two factories: a spin-off (MICRONADIR, S.L.) and SYMBORG, a biotechnology factory, which are interested in the possible biopesticide effect of EVERGREEN peptides	CEBASCSIC	Own resources Around € 4,000	1 year
ASTRA will do two years of EVERGREEN experiment on the same and different fields defining a standard. ASTRA will return the same project fields with the same argument and will tests new types of fields.	ASTRA	Own resources Around € 3,000	2 years
Monitoring of plants long-term adaption after treatment in field with EVERGREEN peptides. After the demonstration of the efficacy of the peptide synthesized and tested during EVERGREEN project, in AfterLife the long-term effect of these molecules will be evaluated. Specific test will be conducted, after plant sampling in field, in analytical laboratories equipped for the determination of target compounds	INSTM and Mondoverde	Own resources Around € 5,000	1 year
Meetings to prepare the proposal for the 2016-2020 Agro-environmental measures for tobacco in Regione Umbria, Toscana, Veneto and Campania	DISPAA, Mondoverde and INSTM	Own resources Around € 1,000	6 months
Development of contacts already initiated during the project with the following stakeholders, Institutions and policy makers: <ul style="list-style-type: none"> ○ Environmental Department of Murcia Area, Regional Ministry of Agricultural of the Comunidad autónoma of Murcia (Dr. Francisco Javier of Murcia, Dra. Encarna of Molina ○ Firenze university rector, Georgofili Director ○ Senator of the Italian Government - Italy ○ Assessorato Agricoltura Regione Emilia-Romagna, ARPA Environmental Institution, Italian business center CENTURIA ○ UNITAB (Union of European Tobacco Growers), CIA (Italian Confederation of Farmers), CONFAGRICOLTURA (General Confederation of Agriculture), FEDAGRI-Confcooperative, OPTA, and OPIT ○ Regione Umbria, Fattoria Autonoma Tabacchi, OPTA and OPIT ○ Politecnico di Milano, UniPR, UniMI, UniPI and Consortium Italtotec ○ Univ. of Kentucky (USA) dr. Mihaylova-Kroumova: sclareol will be the best candidate for future studies due to its antifungal properties and availability. ○ General Manager of SIPCAM-OXON for Biostimulants Sandro Secco, CEO Giovanni Affaba, the President of the Administrative Board Nadia Gagliardini. ○ Lab de Grasas y Aceites Dept. de Ciencia y Tecnología de los Alimentos, Facultad de Química. Montevideo. Uruguay, Dr. Ignacio Vieitez Osorio 	DISPAA and all the beneficiaries	Own resources Around € 2,000	6 months

<i>Activity</i>	<i>Responsible</i>	<i>Resources</i>	<i>Duration after the project end</i>
Predisposition and submitting of a new LIFE project on different applicability of EVERGREEN results In particular in LIFE 2017 call as associated beneficiary in a project coordinated by the company Silvateam on the use of tannins in agricultural and for animal feed	DISPAA, CEBASCSIC and ASTRA	Own resources Around € 1,000	1 year
Website update Each three months UNIFI will update the EVERGREEN website with the technical and dissemination news	DISPAA	Own resources Around € 5,000	3 years
Dissemination in events linked to plant, soil and agricultural sectors. In particular in 2016-2017: <ul style="list-style-type: none"> • CORESTA Congress 2017 • ECOMONDO, Rimini 2017 • AOCs 2017 • ECOFIRA 2016, International Fair of Environmental Solutions, Valencia (Spain), 28th to 29th September 2017 • Event Bright Pisa, Area della Ricerca CNR, 30th September 2017 From 2018 each year some beneficiaries will participate at CORESTA, ECOMONDO and ECOFIRA fairs	All beneficiaries	Own resources Around € 3,000	5 years
Dissemination by means of specialised press In particular: <ul style="list-style-type: none"> • CEBASCS 5 articles in the CSIC newsletters (one for year from 2017) that are distributed in electronic and paper form to CSIC's department and related experimental companies • 1 article on Focus.it, the website of the FOCUS monthly magazine (Mondadori Scienza SpA Edition), the most widespread Italian magazine for science diffusion • 1 article on Platinum journal • 1 article on Corriere Fiorentino 	All beneficiaries	Own resources Around € 2,000	5 years
Networking with H2020 and LIFE projects related to agricultural and soil sectors	All beneficiaries	Own resources Around € 3,000	5 years
Publication of four scientific works to be submitted to the following International Journal: <ul style="list-style-type: none"> - Soil Biology and Biochemistry - Molecular Plant Pathology - European Journal of Soil Science - European Journal of Agronomy - Journal of Plant Nutrition and Soil Science 	DISPAA, CEBASCSIC and INSTM	Own resources Around € 2,000	1 year
Dissemination in European Environmental Centers. In particular: <ul style="list-style-type: none"> - ENEA - ARPAT - University of Madrid, Elche, Murcia and Alicante - ISPRA 	DISPAA, CEBASCSIC	Own resources Around € 1,500	5 years
In November 2017 Mondoverde will organise a workshop with the participation of around 35 agricultural and soil managers	Mondoverde	Own resources Around € 3,000	5 years
Distribution of 5,000 brochures and leaflets during special events, workshops, direct visits, meetings and email	All beneficiaries	Own resources Around € 4,500	5 years

- the demonstration of the reliability and the compliance with REACH document of EU legislation of the extraction processes for these polyphenolic-based molecules, from the lab-scale to the kilo-lab scale.
 - the demonstration of the project technical validity for optimising the up-scaling of treatments with these polyphenolic-based molecules recovered from agricultural vegetable wastes, from laboratory to pilot scale and to semi-industrial scale.
 - the demonstration of the more efficient and ecotoxicologically compatible profile of these bioactive molecules than conventional pesticides, at laboratory, pilot and field scale.
 - the demonstration of the absence of any side unexpected effect of the bioactive polyphenolic-based molecules on common molecular targets of living organisms, at laboratory, pilot and semi-industrial scale.
 - the demonstration of the absence of any direct or cross-acting selection operated by the bioactive polyphenolic-based molecules towards the emergence of unwanted resistance phenomena in their respect or for conventional pesticides, copper or even antibiotics, at laboratory, pilot and semiindustrial scale.
- the demonstration of the short term environmental benefits and the economical advantages from the use of polyphenolic-based molecules recovered from agricultural vegetable wastes in the control of biotic plant diseases.

AFTER LIFE DISSEMINATION STRATEGY

EVERGREEN aimed at innovating the approach towards plant disease control, reducing conventional chemical pesticides with environmentally friendly and highly bioactive molecules recovered from agricultural vegetable wastes. The project had a double goal to simultaneously improve the safety profile of plant disease control products for environmental compatibility and to support the sustainability of plant production to pursue cost-effective strategies. With the present Afterlife Communication plan is guaranteed that the project EVERGREEN will be subject to a large and widespread dissemination even after the official date of completion of the project. This plan is set out to continue the dissemination and communication of the project and its results. This communication plan guarantees the dissemination of results gained throughout the project and the continuance of the demonstration of the tested technologies.

EVERGREEN perfectly meets the EU vision about sustainable agriculture, with the use of renewable resources, such as vegetable not edible biomass and waste, to obtain environmentally friendly substitutes for traditional pesticides against plant pathogenic bacteria and nematodes, avoiding environmental pollution and lowering the costs deriving from both the use of conventional pesticides and the disposal of these wastes. EVERGREEN project is one of the most obvious examples of the tight and important link existing between WFD and the EU Thematic Strategy for Soil Protection, aimed to several actions concerning soil, such as to prevent its degradation, to preserve its ecological and social functions, and also to remediate polluted and degraded soils. In fact, although the framework Directive of EU Thematic Strategy for Soil Protection defines as "soil" everything that is between the earth surface and bedrock, it is obvious that the reductions of soil contamination by several pollutants such as copper, that can be easily runoff into water from soil, would at the end result in the protection of aquatic ecosystems, as asked by WFD. The use of the EVERGREEN antiinfective substances will be a reliable and efficient alternative to the application of chemicals as bactericides against plant pathogenic bacteria, that will contribute to the reduction of chemicals contamination into agricultural soils and water. Consequently, an increase in soil fertility will be also be obtained, as well as an important reduction in the percentage of chemicals resistant bacteria in the soil microflora, that are also a dangerous reservoir of antibiotic-resistant bacteria for humans and animals.

The following table defines the main activities (with specific responsible, resources and timing) which will be carried out in order to guarantee the valorisation and utilisation of the project results after the project end.