

The logo for "AGRI SED" features the word "AGRI" in green and "SED" in brown. A stylized plant stem with three leaves is positioned vertically between the two words, with its base at the end of "AGRI" and its top at the start of "SED".

AGRI SED

Use of dredged sediments for
creating innovative growing
media and technosols for plant
nursery and soil rehabilitation

Layman's
report

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Layman's report

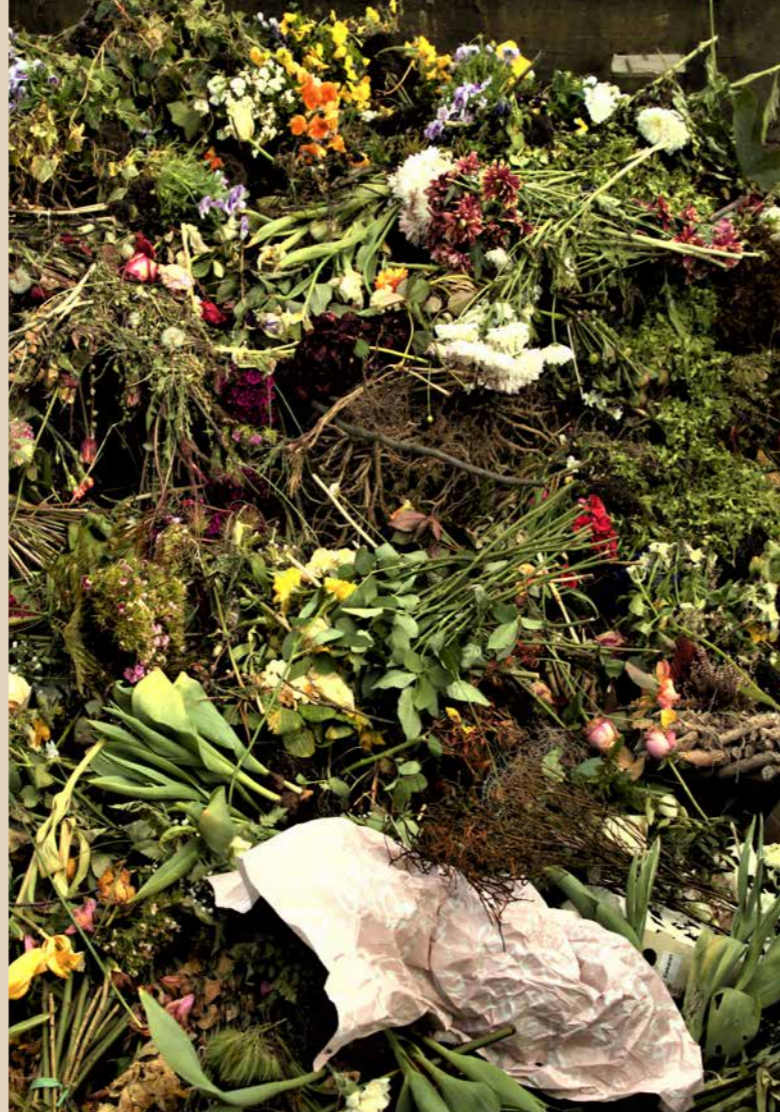
[THE AGRISED PROJECT]



The main objective of the AGRISED project is to demonstrate the suitability of dredged sediments, with no intervention or after co-composting with green waste, to produce reconstituted soils that can be used in the rehabilitation of degraded soils and sustainable substrates for plant nursery.

The project is built on the concept of circular economy. Thanks to the reuse of waste such as sediments and green waste, which often are not adequately valorised but instead disposed with significant environmental and economic externalities, it is possible to obtain new eco-sustainable products:

- the AGRISED substrates allow to reduce the use of traditional substrates containing peat, which has a high environmental impact due to its extraction
- the AGRISED reconstituted soils represent a new solution for the effective and efficient rehabilitation of degraded soils and have good potential for use in green architecture.



[THE ENVIRONMENTAL PROBLEMS ADDRESSED

The AGRISED project was born with the aim to provide a solution for addressing 4 important environmental problems.

THE SEDIMENT

About 200 million m³ of sediment (of which about 60% is polluted) are dredged every year in Europe. Only 5% of these is reintroduced into the production cycle, while the remaining 95% is considered a real waste and disposed of, with relevant social and economic costs.

GREEN WASTE

Around 13 million tons of green residues from agricultural sources are produced annually in Europe. It is estimated that only 10–20% of this waste is adequately treated and valorised (through composting or as biomass for energy production).

THE PEAT

Peat still occupies 80% of the total volume of substrates used in Europe today. Peatlands constitute the natural habitat of various animal and plant species and act as carbon sequestrators: their destruction seriously endangers biodiversity and causes a huge release of greenhouse gases.

THE DEGRADED SOILS

Human activity is the main cause of soil degradation. Soil is a non-renewable natural resource, which performs important ecological, social and economic functions. Restoring soil fertility and productivity requires huge costs and time.





[THE OBJECTIVES OF THE AGRISED PROJECT

1. To validate the co-composting process as a solution for the reuse and revalorisation of sediments and green waste;
2. To validate the use of the substrates obtained using co-compost for the nursery cultivation of ornamental plants;
3. To validate the technosols obtained using sediment and co-compost for the rehabilitation and restoration of degraded soils;
4. To analyse the current regulatory framework both at national and European level, in order to identify any barriers and to prepare actions to overcome them;
5. To promote the transferability and replicability of the proposed solutions, through training and informative actions targeting both the general public and the scientists and professionals working in the sectors involved;
6. To implement a communication campaign about the project, its contents and the LIFE programme's support to environment, in order to increase public awareness and sensitivity on the environmental issues concerned;
7. To involve stakeholders active in the sector of soil, sediment and nursery management through direct communication actions.

[THE RESULTS ACHIEVED]



Parameter monitoring during the co-composting trial carried out in the Czech Republic



Co-compost inside the composters set up specifically for the co-composting trial in Italy

VALIDATION OF THE CO-COMPOSTING PROCESS

During the AGRISED project, two co-composting trials were carried out to evaluate the effectiveness of the process contexts that differ both in the inputs used (different sediments and green waste were acquired locally) and in the different environmental and climatic conditions

The trial in the Czech Republic started in October 2019, while the one in Italy started a year later, in October 2020. For each test, 3 piles were prepared with different ratios between sediments and green waste (3:1, 1:1 and 1:3).

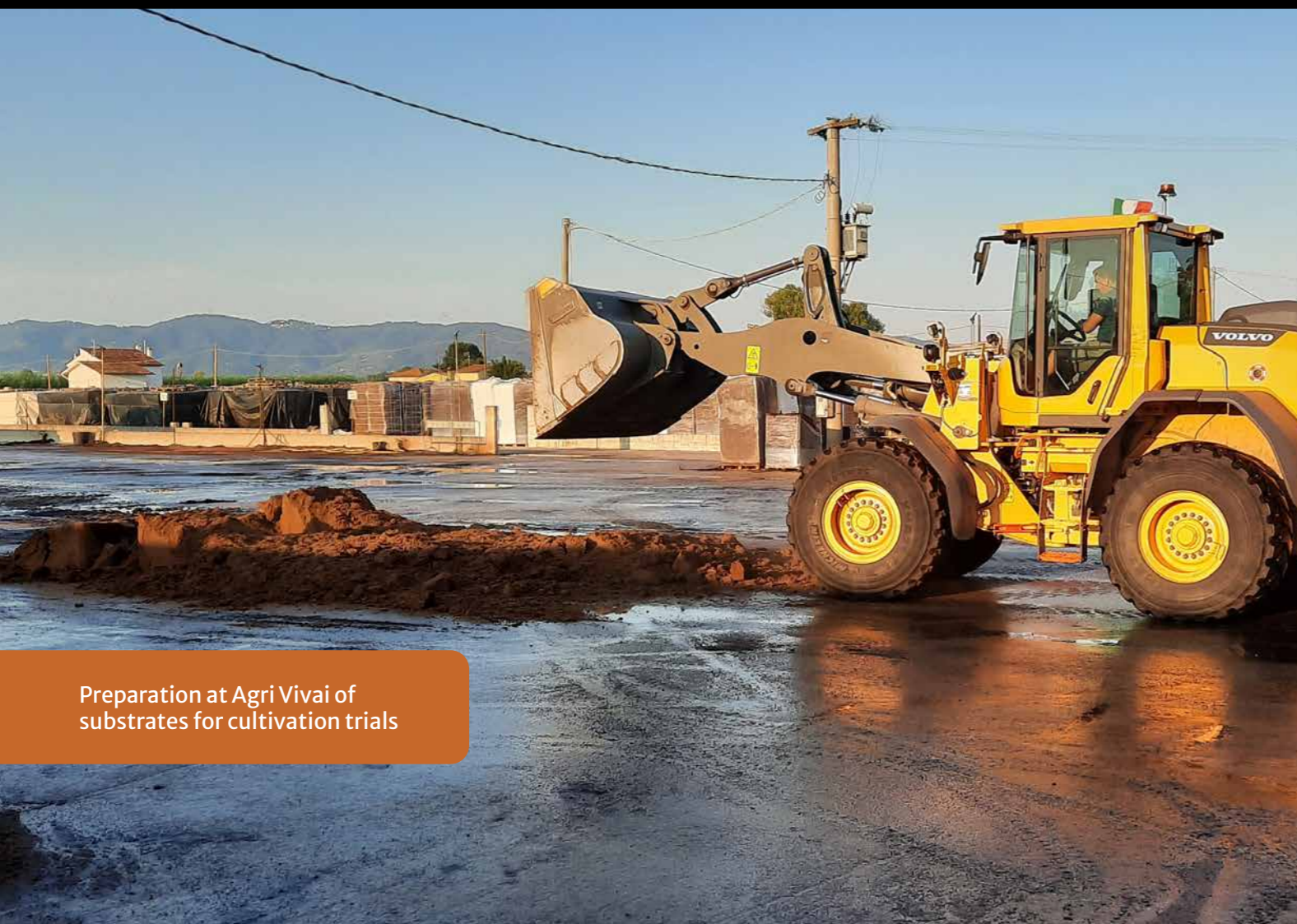
In the Czech Republic, the 3 piles were placed and moved periodically on a composting platform, while in Italy the process was carried out inside 3 waterproofed steel composters.

The process was monitored for about 6 months through both continuous remote measurements and periodical analyses of samples from each pile.

Despite different starting matrices and environmental and climatic conditions, the process proved to be capable of guaranteeing the complete maturation and stabilization of the compost. In addition to being an alternative for the reuse of sediments and green waste, co-composting has also proved to be a valid bioremediation technology for sediment, that has shown a reduction in organic contamination level.



Input matrices for the production of the AGRISED substrates



Preparation at Agri Vivai of substrates for cultivation trials

THE RESULTS ACHIEVED

VALIDATION OF CO-COMPOST-BASED SUBSTRATES

The project originally foreseen the validation of only 3 substrates: the co-composts obtained from the single co-composting trial planned. By doubling the co-composting trials, we moved on to 6 substrates to be validated. Subsequently, based on its own experience, the consortium considered crucial to validate other additional mixtures which, although sometimes only partially replacing the peat, could have been more efficient and suitable for the professional nursery context.

Peat substitution	Composition
Total	Green waste and sediment co-compost (ratio 3:1) from CZ trial
Total	Green waste and sediment co-compost (ratio 1:1) from CZ trial
Total	Green waste and sediment co-compost (ratio 1:3) from CZ trial
Total	Green waste and sediment co-compost (ratio 3:1) from IT trial
Total	Green waste and sediment co-compost (ratio 1:1) from IT trial
Total	Green waste and sediment co-compost (ratio 1:3) from IT trial
Total	50% co-compost 3:1 + 25% coco peat + 25% coco fibre
Total	50% co-compost 1:1 + 25% coco peat + 25% coco fibre
Total	50% co-compost 1:3 + 25% coco peat + 25% coco fibre
Total	25% co-compost 3:1 + 37,5% coco peat + 37,5% coco fibre
Partial	50% co-compost 3:1 + 50% peat + pumice 1:1
Partial	Partial 50% co-compost 1:1 + 50% peat + pumice 1:1
Partial	Partial 50% co-compost 1:3 + 50% peat + pumice 1:1



Cultivation trial in Italy
(autumn cycle in open field)



Cultivation trial in the Czech Republic
(autumn cycle in greenhouse)

The substrates thus produced were enriched with Basacote (slow-release fertilizer) and used in 3 cultivation trials for their validation. The trial were based on the cultivation in different environmental and climatic conditions of *Photinia x fraseri* Red Robin and *Viburnum tinus* plants:


1. Cultivation trial in the Czech Republic (started in October 2020). 140 viburnum plants and 140 photinia plants were grown inside a greenhouse, after autumn repotting;
2. First cultivation trial in Italy (started in October 2020). 280 viburnum plants and 280 photinia plants were grown in the open field, after autumn repotting;
3. Second cultivation trial in Italy (started in March 2021). 160 viburnum plants and 160 photinia plants were grown in the open field, after a spring repotting.

For the entire duration of the trials, the plants grown on the AGRISED substrates and on the control substrates (classic nursery substrate, peat+pumice 1: 1) were monitored by measuring numerous parameters. At the end of the trials, part of the plants was destined for destructive analysis.

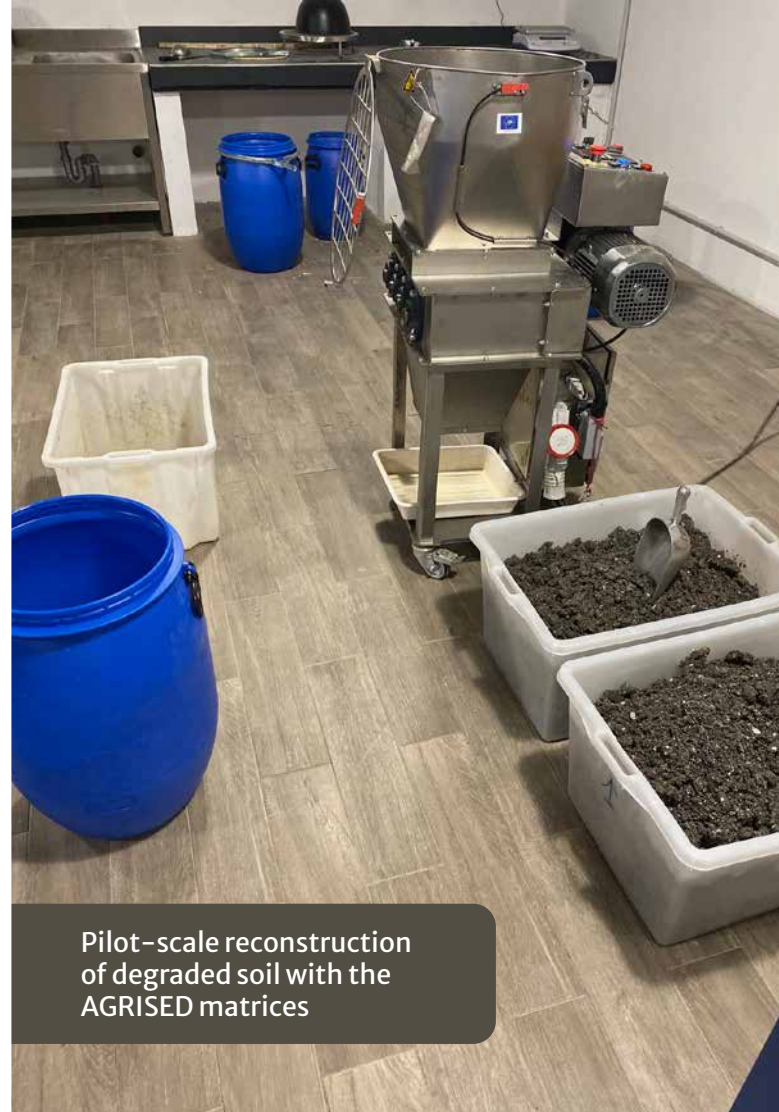
In general, the numerous data collected and analysed highlighted an excellent potential of these alternative substrates, which even surprised the researchers and technicians who took part in the trials!

Despite the use of waste and recycled materials, the growth of plants cultivated on the AGRISED substrates is analogous (or insignificantly lower compared) to the one of plants cultivated on traditional peat-based substrate, both in terms of plant final height and final dry matter obtained.


The quality of the plants was generally satisfactory, as confirmed by the ecophysiological analyses conducted, which did not reveal any stress states in any of the theses compared.



Sediments arriving at the MCM Ecosistemi laboratories



Pilot-scale reconstruction of degraded soil with the AGRISED matrices



The AGRISED reconstructed soils during the trial in soil columns

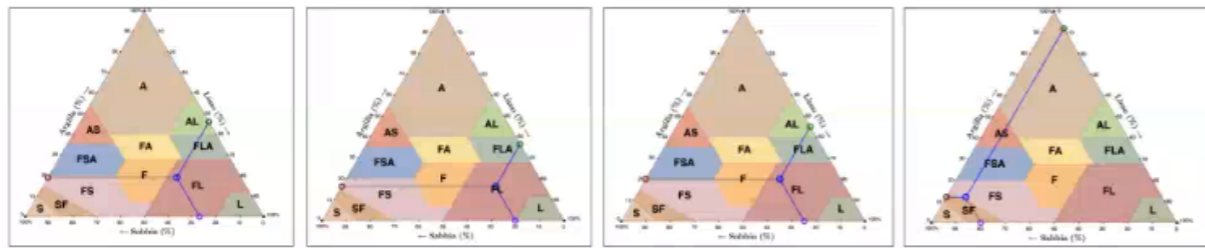
[THE RESULTS ACHIEVED]

VALIDATION OF RECONSTITUTED SOILS BASED ON SEDIMENT WITH NO INTERVENTION AND CO-COMPOSTS

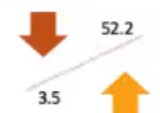
Thanks to MCM Ecosistemi's patented reconstitution technology, sediment and co-composts were used during the AGRISED project as primary matrices for the production of reconstituted soils. These primary matrices, once analysed and dosed through dedicated software (PÉDOGENIA) with other secondary matrices (degraded soil and by products from the paper mill processing), were reconstituted on a pilot scale. The validation was performed through the execution of 2 separate tests:

1. A first trial in soil columns. The primary matrices and reconstituted soils were placed in 18 columns and subjected to monthly wetting. Several chemical-physical parameters were collected through a sensor system (with automatic measurements every 15 minutes) and the bimonthly sampling of leachate and interstitial waters. At the end of the trial, the soil and the matrices were sampled and analysed to evaluate the variations of the main chemical parameters;
2. A second in-pot cultivation trial. The reconstituted soils produced were used for the cultivation of 140 viburnum plants and 140 photinie plants in open field. The analyses carried out during the trial confirm the improvement in the chemical-physical characteristics of the primary matrices used, with a better water retention capacity and a general improvement of all the fertility characteristics. The cultivation trial performed confirms the suitability of these matrices for the cultivation of ornamental plants too.

Analisi fisiche e chimiche



campione	sabbia	limo	argilla	ps	pa	porosità
	%			g cm ⁻³		%
co-compost 1:1	27	54	19	2.035	0.992	51
co-compost 1:3	20	63	17	2.176	0.934	57
co-compost 3:1	25	55	20	2.094	1.143	45
fango dragaggio	79	8	12	2.464	1.302	47



campione	pH	EC	CaCO ₃	CaCO ₃ attivo	C totale	C org	N totale	C/N	S totale
		dS m ⁻¹	g kg ⁻¹ SS						g kg ⁻¹ SS
co-compost 1:1	7.6	4.4	70.2	15.3	51.47	52.2	3.54	15	2.9
co-compost 1:3	7.7	5.7	63.1	14.1	75.90	76.4	6.16	12	3.6
co-compost 3:1	7.7	3.7	88.5	19.1	38.68	36.2	2.60	14	1.7
fango dragaggio	8.2	16.6	78.6	7.5	12.56	3.5	0.51	7	2.7



Piacenza, 09/02/2022

Italian technical course on technosols

THE RESULTS ACHIEVED

VALIDATION OF ENVIRONMENTAL AND ECONOMIC SUSTAINABILITY

Developing solution which is technically valid is not enough, but it is also necessary to evaluate its long-term sustainability, both from an environmental and economic point of view: for this reason a Life Cycle Assessment was conducted (demonstrating the environmental sustainability of the proposed solutions) and a specific Business Plan was developed (confirming the economic sustainability of the solutions, despite the uncertainties linked to the current market trend).

TRANSFER OF KNOWLEDGE AND EXPERIENCE GAINED

At the same time, in order to support the replicability and transferability of the proposed solutions, some workshops (for all audiences) and some technical courses (for professionals and operators of the sectors concerned) were organized. Specifically, 6 training and information events were organized:

- First Italian workshop (online, 7th December 2020)
- Czech technical course (Kunovice, 24th June 2021)
- Czech workshop (Olomouc, 2nd September 2021)
- Italian technical course on substrates (online and live in Pistoia, 9th September 2021)
- Italian technical course on tecnosuoli (online, 9th February 2022)
- Second Italian workshop (Pistoia, 29th March 2022)

At the end of the project, 3 different specific guidelines on AGRISED co-composting, production and use of AGRISED substrates, soil reconstitution with AGRISED-MCM Ecosistemi technology were produced and distributed.



Workshop carried out in the Czech Republic

AGRISED meets the SUBSED project at the Essen 2019 fair



Stefano Lucchetti with Stefania Saccardi, vice president of the Tuscany Region

[THE RESULTS ACHIEVED]

COMMUNICATION AND DISCLOSURE

In addition to the previous specific actions, in order to raise public awareness about the environmental issues addressed, the circular economy theme and the LIFE programme, the consortium implemented an extensive multi-target dissemination campaign.

The project's website and social pages are running. Here it is possible to find articles and updates and the dissemination material produces (brochures, roll-ups, banners, posters, guidelines, presentation, etc.). The dissemination material was also produced on physical supports and distributed together with the LIFE AGRISED gadgets during participation in events and during the daily commercial activities of the partners.

The beneficiaries also participated in some of the most important events in the sector, attending national and international conferences and the most important trade fairs on European and global scale.

SENSITIZATION OF INSTITUTIONS AND STAKEHOLDERS OF THE SECTORS CONCERNED

Specific actions were carried out to reach authorities, policy makers and representatives of associations and NGOs working in the sectors of waste, soil, agriculture and environmental sustainability. This activity was fundamental to sensitize institutions on the presence of regulatory barriers and on the need to harmonize and update the legislative framework.



Presentation of AGRISED in the Czech Senate

[CONCLUSIONS]

The AGRISED project will close on 31st March 2022, but only formally!

The consortium still has a lot of work to do to achieve its final goal. AGRISED has opened a new path for the reuse of sediments and green waste in a circular economy perspective, but the legislation is very strict and – at times – unclear and not linear, placing significant barriers for the production and use of AGRISED products on industrial scale.

The technical, environmental and economic validation obtained thanks to AGRISED reassures about the potential of the proposed solutions. In order to overcome the identified regulatory barriers, at the end of the project a dossier was sent to the competent Italian authorities to try to outline the possible viable paths and encourage support in favour of the transition towards sustainable models of circular economy.

The consortium has prepared an After-LIFE plan to illustrate the next steps to take after the project end. On the one hand, the scientific dissemination and the transfer of knowledge and experience gained during the project will continue, thanks to the activities of the research institutions and the participation in national and international events. On the other hand, the commercial partners will strive to define possible ways for exploiting the project outcomes, also looking for additional resources (public and/or private) to scale up the production and use of AGRISED products on a large scale.

AGRISED really wishes to thank the European Commission, CINEA, the monitor and all those who followed and helped us. Thank you very much and keep following the AGRISED project!



- 63%** Reduction in level of C>12 pollutants in sediments thanks to co-composting
- 1000%** Increase in Soil Organic Matter of degraded soil thanks to reconstitution
- 23%** Reduction in CO₂ emission for plant grown on co-compost-based substrates compared to cultivation with traditional peat-based substrate
- 315** People involved in technical courses and workshops
- 200** People interviewed about their opinion on the addressed environmental issues and the impact of the AGRISED project
- >35** National and international events attended

Beneficiaries



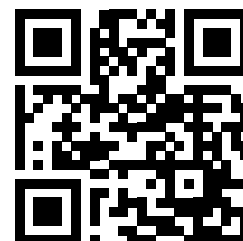
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