AgrEcoMed
FOSTERING AGROECOLOGICAL TRANSITION

"New AGRoecological approach for soil fertility and biodiversity restoration to improve ECOnomic and social resilience of MEDiterranean farming systems"

Deliverable 6.6
Demonstration fields

This project is part of the PRIMA Programme supported by the European Union, having received funding from it under grant agreement PRIMA21_00018

PRIMA
PARTNERSHIP FOR RESEARCH AND INNOVATION IN THE MEDITERRANEAN AREA

This project is part of the PRIMA Programme supported by the European Union, grant agreement PRIMA21_00018

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Acronym and abbreviations

VRT	Variable rate
RIA	Research and Innovation Action
CA	Conventional agriculture
AA	Agroecological approach
WP	Work package

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Executive summary

The AgrEcoMed project, funded under the European Union's Horizon 2020 research and innovation program PRIMA and Grant Agreement PRIMA21_00018 is a research project aimed to fill the research gaps for implementing a biodiversity-based strategy for primary crops as cereal farming systems through an Agroecological approach adapted to environments in Mediterranean countries, efficient use of natural resources, reduction of pollution, circular economy. Such a goal will be achieved through innovative approaches to support the sustainable production of staple foods in the scenario of present and future climate changes. To this end, the project activities will be carried out through on-farm experimentations, focus groups, pilot actions, and demonstrative action. This document is Deliverable 6.2, "Demonstration fields", of the AgrEcoMed project, which aims to describe the demonstration fields of best practices of new crop rotation and innovative farming techniques with an agroecological imprint. The experimental fields will be open to visitors from their start (about 12 months after the start of the project) until the closure of field activities (31 months).

Keywords: PRIMA, AgrEcoMed, on-farm demonstration, dissemination, agroecological practices, sustainable agriculture

1. Project basis

AgrEcoMed is a 36-month Research and Innovation Action (RIA) project under Grant Agreement No PRIMA21_00018 aiming to fill the research gaps for implementing a biodiversity-based strategy for primary crops as cereal farming systems through an Agroecological approach adapted to environments in Mediterranean countries, efficient use of natural resources, reduction of pollution, circular economy. The effective start of the project is 23/05/2022 and the project ends 36 months later, on 31/05/2025. The AgrEcoMed consortium consists of 8 partners from 4 countries (including two EU and non-EU countries). The project is coordinated by the University of Basilicata (UNIBAS, Italy). The list of Project Participants is included in the Grant Agreement, in the Consortium Agreement, and presented in Table 1. The project has an overall budget of 1,308,051.15 €. The budget detailed per beneficiary and the corresponding EU contribution of each beneficiary is detailed in Annex 2 to the Grant Agreement – Estimated budget of the action.

Table 1. Partners of the AgrEcoMed project and representatives.

Participant No *	PI name	Organization	Short name	Country	Type of institution
P1	Michele Perniola	University of Basilicata	UNIBAS	Italy	Higher Education Institution
P2	Luigi Roselli	University of Bari	UniBa	Italy	Higher Education Institution
P3	Maria Assunta D'Oronzio	Council for Agricultural Research and Economics	CREA	Italy	Public Research organization
P4	Ines Yacoubi	Centre of Biotechnology of Sfax	CBS	Tunisia	Public organization
P5	Hanine Hafida	University Sultan Moulay Slimane Beni Mellal	USMS	Morocco	Higher Education Institution
P6	Said Ennahli	National School of Agriculture	ENAM	Morocco	Public Research Organisation
P7	Julio Berbel	Universidad de Córdoba	UCO	Spain	Higher Education Institution
P8	Neus Sanjuan Pellicer	Universitat Politècnica de València	UPV	Spain	Higher Education Institution

2. Introduction

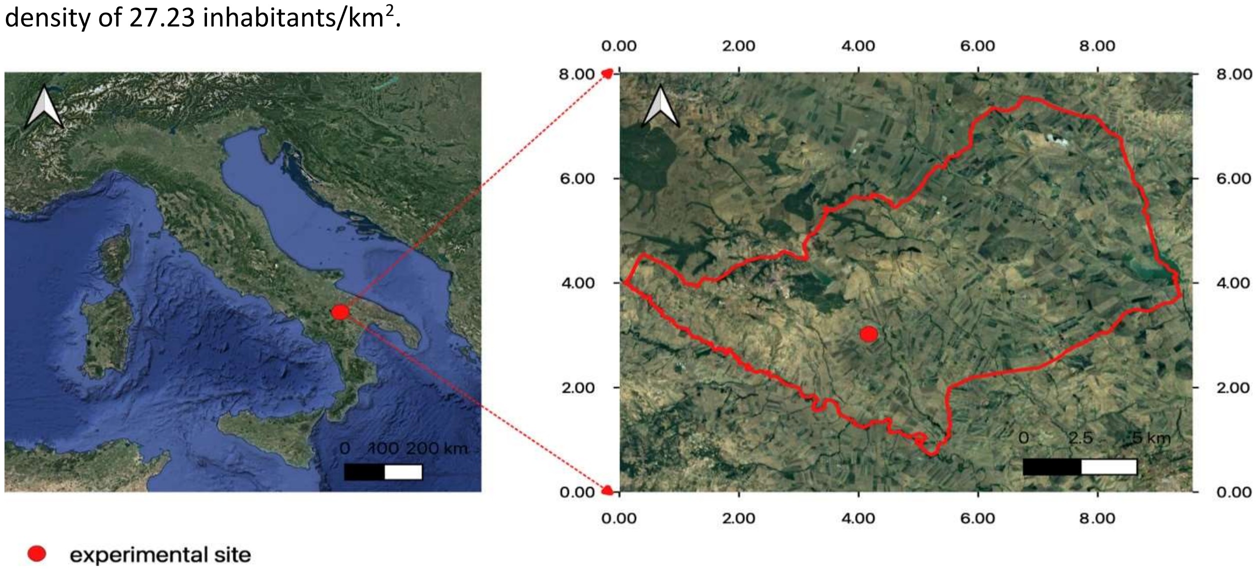
The activities aim at widely informing about the project approach and results to foster and facilitate the adoption and exploitation of the methodology in different contexts. One of the main tasks of the AgrEcoMed Work Package 6 “Dissemination of results” was to have active participation and involvement in public international events to inform both the research/scientific community and the industry sector about the project and disseminate and exploit the scientific and non-scientific results of the project. Deliverable D6.6 disseminate and promote the demonstration fields of the project.

3. Demonstration fields

A 3-year field trial (2022-2023-2024) will be conducted in the real setting farm in the Mediterranean area, comparing the cropping system practiced (conventional agriculture CA) with an alternation one in which, in addition to the introduction of new alternative crops, the cultivation technique will be set based on agroecological principles, the agronomic correctness of the individual cultivation technique interventions (rotation, tillage, fertilization, defense, etc.) and the consistency that the specific methods of farm management demonstrate they possess concerning environmental, social, cultural, economic conditions, etc. of the cultivation site (AA). In the above-said farms, “conventional agriculture” (CA) will be compared with the proposed “agroecological approach (AA). On the same rotating plots cultivated in the farm, part of the surface will be used to test the management regime on an agroecological basis (AA). Specifically, wheat and legumes will follow the same rotation scheme already in place on the farm, but the newly established varieties grown on the farm will be compared with the alternative varieties. The rotation scheme will instead be expanded (to increase the degree of biodiversity) by introducing and allocating part of the area for the cultivation of a brassica crop and a medicinal plant. In this rotation, wheat maintains the role of the main crop (given its suitability to the cultivation area), the leguminous for the balance of nutrients in the soil, the grass for improving and refining crops against weeds, the brassica crop for the soil pathogens control and finally the medicinal crop for triggering green chemistry chains with the possibility of producing extracts also useful for the agricultural sector itself in a circular economy perspective. Following the rotation scheme, the 5 crops in the rotation will all be present in each of the three years of experimentation. To make the management of rotation more ecological, in compliance with the knowledge acquired in the agronomic research, the tillage plan in the AA rotation will provide for plowing at 30 cm on legumes and medicinal crops (to better contain both weeds and the pathogens on these two crops which are more sensitive) and the minimum tillage on wheat and brassicas (where the control of weeds and pathogens is easier). This is to contain the carbon footprint on the one hand due to fuel consumption and to take advantage of the positive effect of plowing on the control of pathogens, weeds, and the physical characteristics of the soil, also for successive crops in rotation. The plant nutrition will be ensured by calculating the plant needs according to the crop potential uptake, the spatial variability and availability of the soil, and crop status due to the climatic trend of the cultivation period. On this basis, the DSS for the fertilization plan will be customized and used for the variable rate distribution of fertilizers through the "precision farming" technique. In the calculation of nutrients, the contribution deriving from the burying of crop residues from previous years will be considered (and this will allow for reducing the fertilizer doses), and organ-mineral fertilizers from the composting of crop residues and urban waste will be used, with a view to of circular economy and low environmental impact. The crop residues will be managed both through the burying and possible shredding in the field, and, based on the physicochemical characteristics and the isoumic coefficient, to start the farm composting processes to obtain a more stable and more effective fertilizer-soil conditioner (ENAM). In particular, we will study the possibility of using medicinal crop residues to obtain macerates which are also useful for the control of some plant pathogens. The crop residues will also constitute the substrate for their enhancement through the bioconversion operated by the Diptera Hermetia Illucens (WP3, task2, UNIBAS). Also, plant health and performance will be assessed to evaluate the benefits of these treatments. An environmental analysis of the processes that allow the self-production of fertilizers and/or amendments for agricultural soil will be carried out, starting from the residues of crop cycles or other organic waste. These processes will be carried out on locally selected farms in participating countries. Weeds and pathogens control in the AA rotation will be carried out based on monitoring the damage threshold; commercially available low-impact bio-molecules will be used and will be compared to the traditional one.

3.1 Experimental site description

The site is within L'azienda Soc. Coop. Agricola La Generale [latitude: 40.82460° N, longitude: 6.09348° N.] located in C.da Pezzalonga c.p.24, 85013 Genzano di Lucania, Potenza, the Basilicata region of southern Italy. The territory of the municipality of Genzano di Lucania has an area of 208.92 km^2 and a population density of 27.23 inhabitants/km^2.



Source (Denora et al., 2022)

Figure 1. Location of demonstration fields.

The experimental site is characterized by hot summers followed by cold winters and with rainfall concentrated in the autumn-winter seasons. The mean annual precipitation is nearly 610 mm (Table 2). The average annual temperature is 19.2°C. The maximum average of the hottest month (July) reaches 28.1°C, and that of the coldest month (January) is 3.3°C.

Table 2. Climatic parameters for Genzano di Lucania, Basilicata region, Southern Italy.

Month	Precipitation (mm/month)	Wet days	Tmp. min. (°C)	Tmp. max. (°C)	Tmp. mean. (°C)	Rel. Hum. (%)	Sunshine (%)	Wind (2m) (m/s)
Jan	59	11.5	3.3	9.7	6.5	76.3	42.1	3.1
Feb	55	11.1	3.5	10.4	6.9	73.8	42.8	3.2
Mar	52	11.2	4.8	12.6	8.7	71.2	44.8	3.2
Apr	49	10.3	7.4	16.2	11.8	69	49.4	3.1
May	40	7.8	11.4	21	16.2	68.1	56.1	2.6
Jun	35	6.7	15	25.1	20	65.1	61.4	2.5
Jul	23	4	17.5	28.1	22.8	61.7	69.9	2.5
Aug	33	5.6	17.8	28	22.9	63.6	69.9	2.4
Sep	51	7.1	15.1	24.5	19.8	66.1	63.5	2.2
Oct	67	9.7	11.3	19.4	15.3	71.2	55.5	2.4
Nov	72	11	7.4	14.8	11.1	75.7	47.1	2.8
Dec	71	12.1	4.5	10.9	7.7	77.3	40.8	3.1

The average relative content of particles of various sizes in the soil is 39.3% for clay, 25.9% for silt, and 34.9% for sand. Therefore, the soil of Genzano di L. is classified as clay loam and is moderately calcareous with a moderate alkaline pH being more than 8.2 (Figure 2). The textural class of top and subsoil using the triangular diagram is shown in Figure 3. The average soil Electrical conductivity (EC) 1:2.5 is 0.26 mS/cm. The average available water content is 100 mm. The average field capacity of the soil is **35**% while the wilting point is 22%. The average humidity is 30%. Elevations range from 347 to 365 meters above sea level (Figure 4).

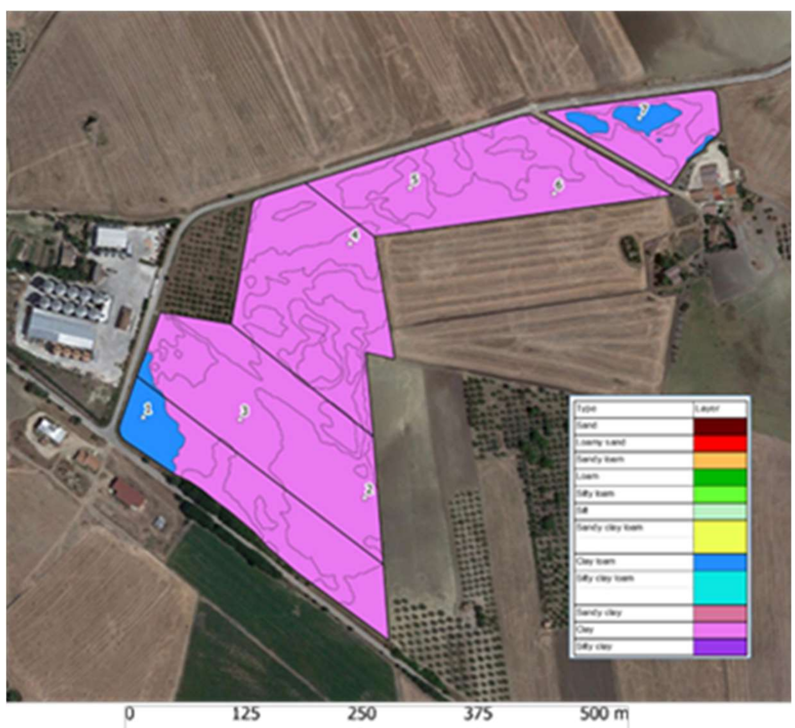


Figure 2. Soil texture of demonstration fields.

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The average nitrogen content is 1.2 g/kg while organic carbon is 1.2%.

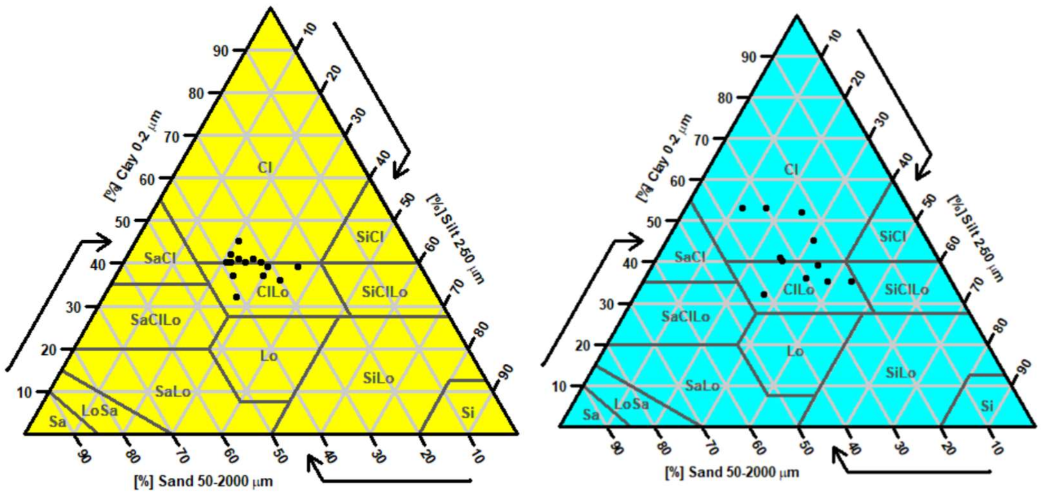

Figure 3. The triangular diagram of the basic soil textural classes of topsoil (yellow/left) and subsoil (blue/right).

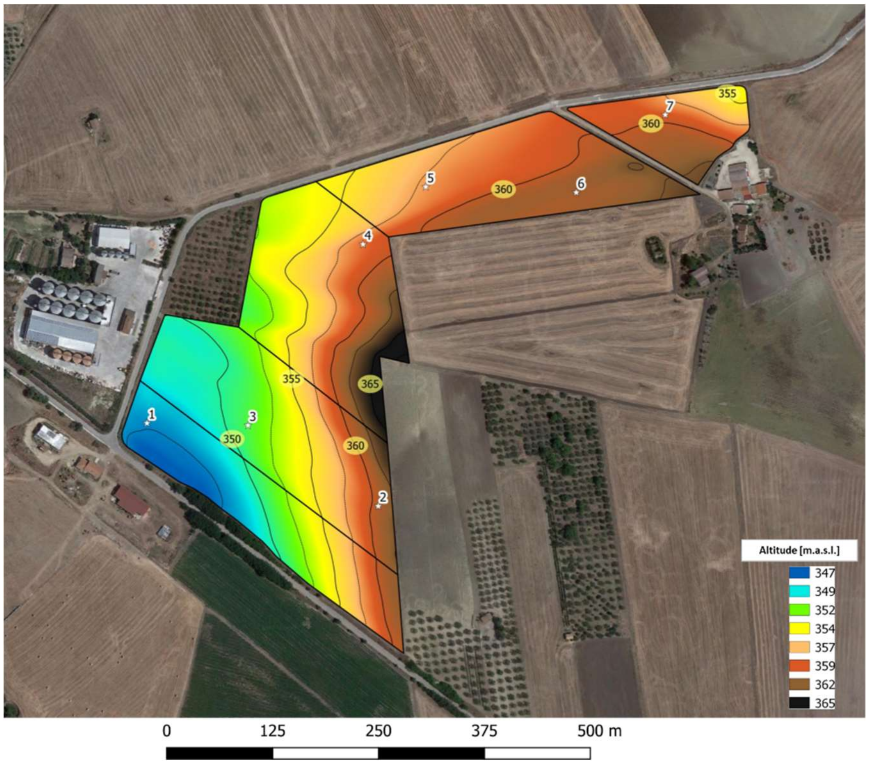

Figure 4. The altitude of demonstration fields.

3.2 Experimental design and management

The demonstration fields are organized in different demonstration plots (Figure 5) hereafter identified as mono-cropping, legumes, intercropping, cereals, and medicinal. The trial will be conducted under rain-fed conditions using a randomized block design. Field operations included primary and secondary tillage, fertilizer application, planting, harvesting, and post-harvest straw management for all plots.

Figure 5. The layout of demonstration fields.

Table 3. Demonstration plots, size, and crops selected.

Plot names	Area [ha]	Crops
Mono-cropping	1.04	Wheat (cv. Tirex)
Legumes	2.73	Protein pea (cv. Aviron), Chickpea (cv. Pascià), Chickpea (cv. Sultano), Lentil (cv. Eston), Lentil (cv. Laird)
Intercropping	2.1	Wheat (cv. Tirex), Vetch (cv. Ereica), Trifolium incarnatum (cv. Kardinal)
Cereals	3.04	Wheat (cv. Tirex), Wheat (cv. Svevo), Wheat (cv. Marco Aurelio); Wheat (cv. Senatore Capelli)
Medicinal	2.91	Rapeseed (cv. SY Harnas), Coriander (Coriandrum sativum), Mugworts (Artemisia)

Table 4. Cropping strategies.

No	Cropping strategy	Plot location
1	Wheat mono-cropping (cv. Tirex) - seeding rate at 250 kg/ha	Mono-cropping
2	High input wheat mono-cropping (cv. Tirex) - seeding rate at 250 kg/ha	Cereals
3	Wheat (cv. Tirex) - seeding rate at 250 kg/ha	Cereals
4	Wheat with Trichoderma technology/strains - seeding rate at 250 kg/ha	Cereals
5	Wheat (cv. Tirex) - seeding rate at 250 kg/ha - with compost	Cereals
6	Wheat (cv. Svevo) - seeding rate at 250 kg/ha - with compost	Cereals
7	Wheat (cv. Tirex, M. Aurelio, Svevo, and Cappelli) - seeding rate at 250 kg/ha - with inorganic soil conditioner (Bioreactive)	Cereals
8	Wheat (cv. Tirex, M. Aurelio, Svevo, and Cappelli) - seeding rate at 250 kg/ha - without inorganic soil conditioner (Bioreactive)	Cereals
9	Wheat (cv. Tirex) - seeding rate at 250 kg/ha - with only biostimulants (BlueN)	Cereals
10	Wheat (cv. Tirex) - seeding rate at 250 kg/ha - with only fertilization	Cereals
11	Wheat (cv. Tirex) - seeding rate at 250 kg/ha - with fertilization and biostimulants (BlueN)	Cereals
12	Wheat (cv. Tirex) - seeding rate at 250 kg/ha	Intercropping
13	Wheat (cv. Tirex) - seeding rate at 150 kg/ha	Intercropping
14	Wheat (cv. Tirex) - seeding rate at 150 kg/ha (cv. Tirex) with Vetch (*Vicia sativa* L.) seeding rate at 80 kg/ha	Intercropping
15	Wheat (cv Tirex) seeding rate at 150 kg/ha with Clover (trefoil) seeding rate at 35 kg/ha	Intercropping
16	Protein pea (cv. Aviron) - seeding rate at 180 kg/ha	Legumes
17	Chickpea (cv. Pascià) - seeding rate at 230 kg/ha	Legumes
18	Chickpea (cv. Sultano) - seeding rate at 200 kg/ha	Legumes
19	Lentil (cv. Eston) - seeding rate at 220 kg/ha	Legumes
20	Lentil (cv. Laird) - seeding rate at 100 kg/ha	Legumes
21	Rapeseed (cv. SY Harnas) - seeding rate at 3.5 kg/ha	Medicinal
22	Coriander (Coriandrum sativum) - seeding rate at 20 kg/ha	Medicinal
23	Mugworts (Artemisia) - seeding rate at 22.7 and 44.45 seedling/ha	Medicinal

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4 Photo album of demonstration fields

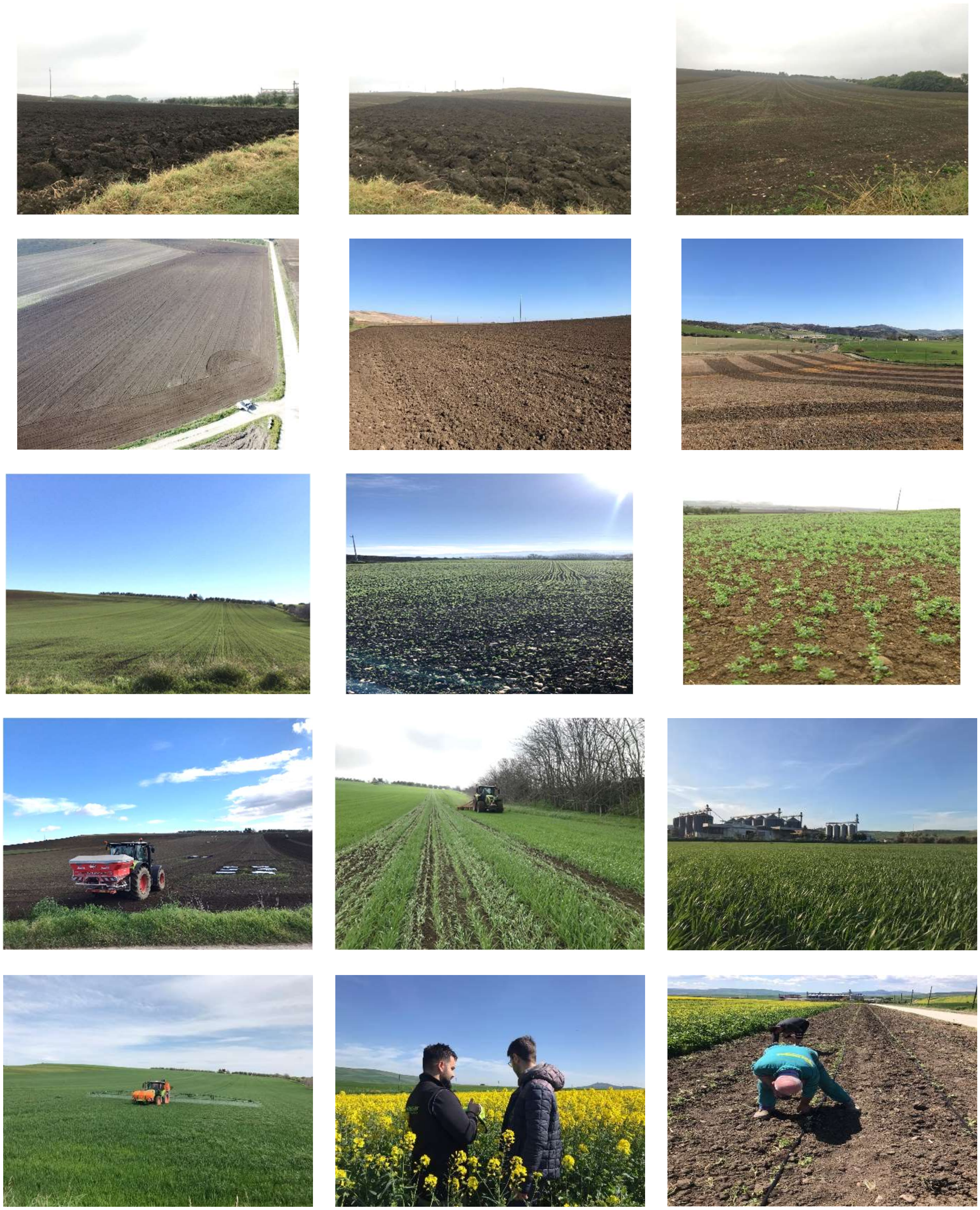

Figure 6. AgrEcoMed demonstration fields of Genzano di Lucania (Basilicata region) at different cropping stages and field operations.

5 Activities for dissemination

Communication, dissemination, and publication activities are key elements for project management. The main goal of communication, dissemination, and publication activities is to reach out to the widest possible range of stakeholders to promote further exploitation of the project results within key stakeholders and relevant communities. To ensure effective coordination, internal and external communication, and innovation management, the role of managing dissemination and exploitation is included in the "Information and Publicity" Work Package, WP6.

Figure 7. Flyer of informative seminar co-organized by AgrEcoMed.

5.1 AgrEcoMed Informative seminar

The information seminar entitled "Integrated production. The system for minimizing the use of synthetic chemical products and rationalizing fertilization, according to ecological, economic and toxicological principles" was organized by the Agroecological Circle of the Murge and Bradano involved in AgroEcoMed activites. The seminar took place from 16:00 to 19:00 in room D001, at the CAMPUS UNIBAS of Matera, located in Via Lanera n. 20.

Figure 8. Participants on the informative seminar co-organized by AgrEcoMed.

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5.2 Farmers Demonstration day

On 18th May 2023, Proteagri project and Coop. Agricola La Generale (implementing partner of AgrEcoMed) organised a Farmers Field Day at the at the Cooperative La Generale di Potenza. The objective was disseminate Technologies for the reduction of the protein gap in agricultural systems intended for human and animal nutrition. About 150 farmers and technicians from surrounding areas were present at the farmers' field day. At the farmers' field day ceremony, Prof. Michele Perniola, Project Coordinator of AgrEcoMed delivered a brief speech on the project goals and objectives and gave an overview of demonstration fields of AgrEcoMed. The event was disseminated via local news via RAI TG. https://www.rainews.it/tgr/basilicata/video/2023/05/dalla-basilicata-un-progetto-per-ridurre-impatto-ambientale-de07f2ad-4a4b-4368-9a41-da98f6d48367.html?nxtep.

Figure 9. Farmers Field day at Cooperative La Generale di Potenza.

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5.3 Workshop AgriWorld 2023

The first edition of the international conference “Resilience and sustainability of hazelnut farming: a regenerative approach” was held on 19 and 20 May 2023 in the Aula Magna of the Macchia Romana Campus of the University of Basilicata. Many activities, exhibition spaces, workshops and thematic seminars on agriculture were scheduled. Innovation, research and sustainability was the three main themes of this first edition of the event with a particular focus on the latest innovations in the agricultural and agri-food sector with an emphasis on agro-ecology, circular economy, protection of the soil, resources and 'environment.

Figure 10. Flyer of AGRIWOLD 2023.

A series of presentation (as below) was held where some of AgrEcoMed activites and synergies were presented.

I. Session: ORGANIC BETWEEN TRUTH AND FAKE NEWS Organic agriculture: the technical means and the admitted operations.
   - 12:15 “Organic cereal cultivation” **- Michele Perniola – Unibas DICEM – Presidente Società Italiana Agronomia**

II. Session: The revolution of fertilization 4.0 for nut nutrition - https://www.eventoagriworld.it/nutrire-per-custodire-la-terra/
   - **16:40** “What changes by applying new generation fertilizers at variable rates?” **- Michele Perniola – Unibas DICEM – Presidente Società Italiana Agronomia**

III. Session: Bioreactive for soil improvement - https://www.eventoagriworld.it/le-radici-del-benessere/
   - **ore 10:45** “The technological transfer of research in vegetable production” - **V. Candido e M. Perniola** – Professori **Unibas DICEM**

References

Denora, M., Amato, M., Brunetti, G., De Mastro, F., Perniola, M., 2022. Geophysical field zoning for nitrogen fertilization in durum wheat (Triticum durum Desf.). PLoS One 17, e0267219. https://doi.org/10.1371/journal.pone.0267219