CAMA PROJECT FACTSHEET

CAMA Project: a research-based participatory approach for adopting Conservation Agriculture in the Mediterranean area

CONTEXT AND WORK DONE IN CAMA

Conservation Agriculture (CA) is based on three key principles, namely, no- or minimum-tillage, soil cover with crop residues, and use of crop rotations. Crop residue disposal on soil surface is expected to increase soil carbon content, compared to conventional, tillage-based cropping, where residues are generally removed from the field. Besides, based on experimental evidences of increased water productivity under sub-optimal rainfall conditions and better soil moisture content, CA has been attributed the potential for mitigating negative effects from future climate change, when rainfall is projected to decrease and be more unreliable.

Adoption rates of CA in Mediterranean countries, however, remain low despite more than three decades of research, development investments and, in the EU countries, economic subsidies, representing about 2% of the arable crop area for EU countries and 0.8% only for African countries.

CAMA project aims to overcome the obstacles – social-economic-agronomic-technological - to the CA diffusion in the 8 target countries of the Mediterranean basin, with the participation of local farmers' associations, technicians and stakeholders.

The main objectives are:

1. **Identifying the major social, economic and agronomic barriers to CA implementation** by smallholders of Mediterranean countries;
2. Establishing a **network of CA experiments** and farmers associations adopting CA to apply a participatory research approach;
3. Improving **legume-based rotations** in rainfed CA cropping systems, with genomic and farmer-participatory research aimed to enhance legume crop yield and resilience and research on crop/residues management;
4. Quantifying the effects of CA application and developing agronomic innovation, to **increase soil fertility, soil physical status, nitrogen and water use efficiencies, and to decrease soil erosion**;
5. **Disseminating the CA concept and techniques in Mediterranean countries**, tailoring them to the specific pedo-climatic and socio-economic conditions;
6. Increasing technicians', advisors' and farmers' **know-how for a better adoption of CA**, by means of the organisation of two training courses.

The CAMA Consortium was created while keeping in mind the complexity of the agricultural production system requiring a multi- and inter-disciplinary (agronomy, genetics, economy, soil science, microbiology) approach to exploit positive synergies and achieve durable innovations aimed at optimising nutrient and water use, improving cropping systems' resilience to climate change, reducing agro-environmental and socio-economic pressures.

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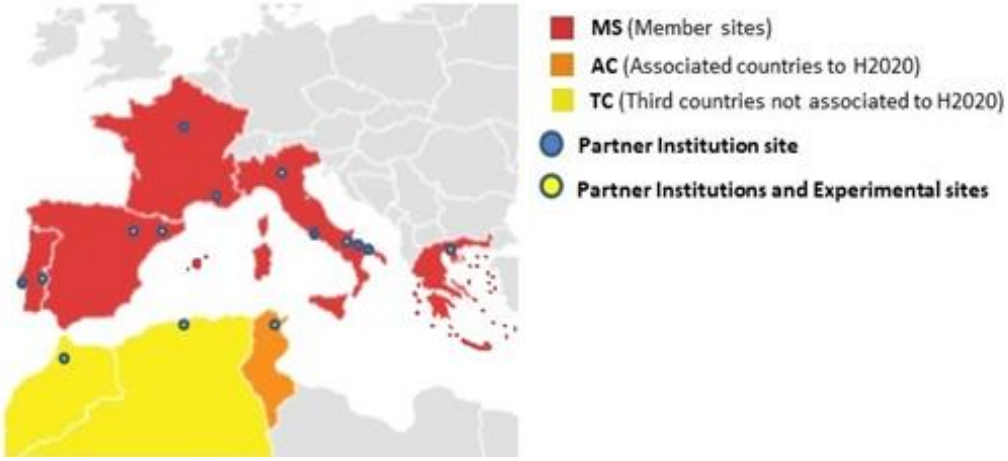

Fig. 1. Map of countries and experimental fields involved in the CAMA project

All consortium partners are highly experienced in CA and have been working together in previous projects. Some partners are farmers' associations (APOSOLO, APAD and AGROMNIA), seven are research institutions (CREA, INRA, INRAT, ARVALIS, CSIC, INIAV and HAO-Demeter), two are universities (Univ. of Lleida, ENSA) and one is an International Organization specialised in agricultural post-graduate training and cooperation (IAMZ-CIHEAM). The 13 partners belong to 8 Countries all representatives of pedo-climatic and social conditions of the Mediterranean Countries (Italy, France, Spain, Portugal, Greece, Tunisia, Algeria and Morocco) (Fig. 1).

The field experiment sites, mainly long-term experiments about CA, will be monitored and supplemental research activities about yield stability, soil chemical and hydraulic characteristics will be carried out.

The project, organized in 7 Work-Packages allowed a good interrelationships among partners and data flow, as well as an efficient development of communication and dissemination activities. The three parts of the project, socio-economic evaluation, research and outputs (Fig. 2) have been linked successfully to a participatory approach that identified the innovation needs and multiplied the effectiveness of the impact of the project outcomes.

The two organized training courses have been oriented to the technicians and to the farmers; field visits, workshops, scientific and technical publications have been also organised and produced.

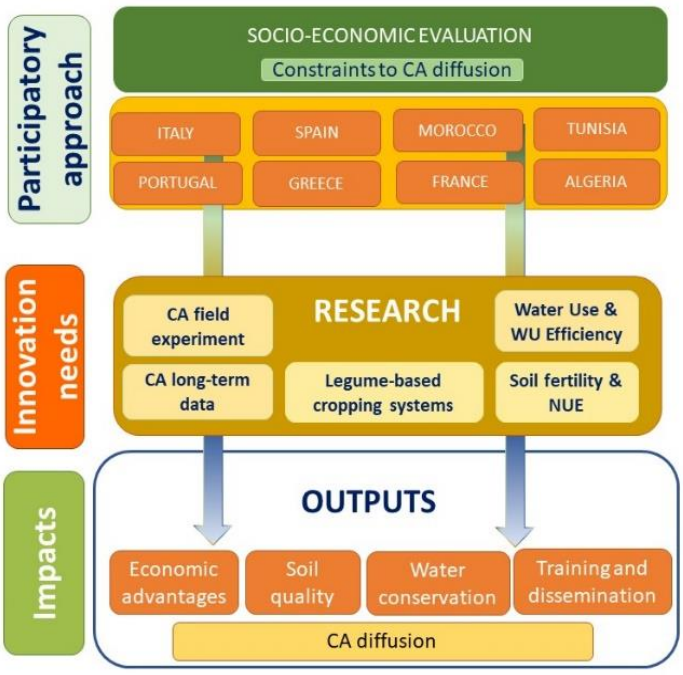

Fig. 2. CAMA project structure

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RESULTS

About the **barriers to CA adoption**, emerged as policy and socio-cultural barriers prevail over agronomic, pedo-climatic and the economic ones. Among the political barriers the need of farmers to receive more public support to adopt CA appears to be a major aspect. The greatest difficulty of economic barriers is represented by the purchase and use of no-till seeder machinery. In specific conditions (extreme hot summer) the pedo-climatic barrier hinder the adoption of CA, in particular the crop diversification (summer cover crops); among other agronomic barriers the lack of active markets for cover crops in some Countries is a problem; the management of crop residues is hampered by the need to use forage by livestock and difficulty in managing weeds and pathogens in the presence of crop residues.

A large number of scientific articles has been supplied in **the agronomic issues**, specifically by the research groups from Tunisia, Algeria and Morocco. Emerged positive effects of CA (or NT) on Carbon stock, microbial biomass carbon, and activity, soil quality properties (aggregate stability and organic matter content). Advantages have been also pointed out on intercropping chickpea-durum wheat, with an improving of NUE and WUE in intercropping.

About **soil quality**, and the capability of CA to affect soil hydrological properties has been carried out in Italy and Spain, with several scientific articles. Some of them have been finalized to assess new methodologies for soil water infiltration and retention, after severe rainfall events and in tilled and no-tillage conditions. Some other articles aimed to evaluate the difference between NT and CT, showing greater bulk density, relative field capacity, organic and extractable C contents and exchangeable K under NT.

The research groups of Italy, Morocco and Algeria produced interesting results on **legume crops**. For alfalfa breeding, has been assessed genomic selection ability to predict breeding values for drought-prone agricultural sites of Algeria, Morocco, Argentina, Italy and Tunisia. For peas, the genomic selection displayed an efficiency close to that of phenotypic selection, and nearly two-fold greater efficiency when also taking into account its shorter selection cycle and smaller evaluation cost.

The list and the link of **articles published during the project**, is reported on the project website.

A more general paper about the needs of research on CA has been also published (Rinaldi et al., 2022).

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The **dissemination** has been carried out by means of the organization of field days in the participant countries, use of social networks, production of the website, the logo, the brochure and fact-sheets, almost all translated in the languages of the partners. Two training courses have been also held, one on-line more scientific, and another in presence, more practical.

CONCLUSIONS

In the four years of the CAMA project:

- we **identified the main social, cultural, technical and financial barriers to CA adoption**;
- the experimental results demonstrated the **positive effect of CA on crop yield, especially in rainfed conditions;**
- we advanced in target **breeding to find legume varieties** drought resistant and more adapt to CA situation;
- we observed the **positive effect of crop rotation** adoption and length, **reducing competitive weed** diffusion;
- it has been noted the important and helpful **effect of CA on soil quality and soil water conservation**, for improving soil water infiltration rates;
- the **need of learning and training** has been raised to **increase technical level to the CA adopters**; finally, the dissemination and the demonstration events, very useful from farmers' perspective for CA adoption, helped to **transfer the know-how** about CA to the farmers and to the stakeholders

References

Rinaldi et al., 2022. *Open Questions and Research Needs in the Adoption of Conservation Agriculture in the Mediterranean Area.* Agronomy, 12, 1112. https://doi.org/10.3390/agronomy12051112

Contact of authors

Michele Rinaldi – CREA, Italy, michele.rinaldi@crea.gov.it

PARTNERS INVOLVED