

# Research-based participatory approaches for adopting Conservation Agriculture in the Mediterranean Area



## Deliverable 3.1

### Set of suggested technical improvements for the 4 themes for each Country

**Authors:** Danilo Marandola (CREA), Luana Circelli (CREA), Giuseppe D'Alessandro (Agromnia).

#### Copyright

“Copyright and Reprint Permissions. You may freely reproduce all or part of this paper for non-commercial purposes, provided that the following conditions are fulfilled: (i) to cite the authors, as the copyright owners (ii) to cite the CAMA Project and mention that the EC finances it, by means of including this statement “Research-based participatory approaches for adopting Conservation Agriculture in the Mediterranean Area, (CAMA, GA, no.1912) is financed by the PRIMA programme supported by the EU H2020 research and innovation programme” and (iii) not to alter the information.”



**PRIMA**  
PARTNERSHIP FOR RESEARCH AND INNOVATION  
IN THE MEDITERRANEAN AREA

The CAMA project (Research-based participatory approaches for adopting Conservation Agriculture in the Mediterranean Area, GA, no.1912) is part of the PRIMA programme supported by the EU H2020 research and innovation programme.

## Executive summary

One of the goals of WP3 is to define the main research needs for smallholder to test innovative solutions regarding several CA agricultural aspects under different conditions.

This Report (namely Deliverable 3.1 - Set of suggested technical improvements for the 4 themes for each Country) summarizes the results of a needs' assessment done in parallel to WP2 and following the "Diagchamp method" promoted by WP3 in each Country. It is largely based on the results of a series of focus groups organized in each one of the involved Countries to discuss with local farmers the results obtained through the online survey performed under WP2 (see Deliverables 2.3 and 2.4).

The Report, beyond a series of preliminary information (e.g., number of participants for each focus group, location of participants, current experience in CA adoption), summarizes -per each partner Country - the information collected during the focus groups organizing the needs of farmers, and identifying possible improvements to be tested, according the 4 key themes identified by WP3 as highly relevant to improve the CA management (weed control, seeding, crop fertilization and crop rotation).

## Table of contents

1. Materials and methods .....	4
2. General results .....	4
3. Country results .....	5
3.1 Farmers' needs in Algeria .....	5
3.2 Farmers' needs in France .....	6
3.3 Farmers' needs in Greece .....	7
3.4 Farmers' needs in Italy .....	8
3.5 Farmers' needs in Morocco .....	9
3.6 Farmers' needs in Portugal .....	10
3.7 Farmers' needs in Spain .....	11
3.8 Farmers' needs in Tunisia .....	12

## 1. Materials and methods

Information collected during the focus groups have been summarized organizing the needs of farmers according the 4 key themes identified by WP3 as highly relevant to improve the CA management:

- Theme 1: Weed control
- Theme 2: Seeding
- Theme 3: Crop fertilization
- Theme 4: Crop rotation

Data have been collected from the reports of the focus groups carried out in each partner Country. Focus group reports are collected as Annex 1.

On the basis of the farmers' need collected a set of possible technical improvements to be tested is suggested for each partner Country involved in CAMA.

## 2. General results

The analysis of the focus groups conducted in the 8 CAMA partner Countries returns a quite homogeneous picture of farmers' needs in view of CA adoption. This potentially leads to the identification of a unique set of technical improvements to be proposed in task 3.2 in view of enhancing the diffusion of CA. In general it should be emphasized that, in all the contexts considered, intangible needs seem to prevail as strategic elements for the development and diffusion of CA, at least at this stage of development and spread of CA. Among these, elements such as the enhancement of knowledge/training actions to farmers and of dedicated advice services seem to be perceived as essential factors. In addition, needs related to the enhancement of cooperation and exchange of experiences between expert-and-less expert farmers is also perceived as a crucial element. Above all, the demand for economic support dedicated both to the purchase of machineries and to the remuneration of the environmental benefits connected to the CA appears to be very recurrent. With regard to more technical aspects, a summary of the needs that emerged respectively for each of the 4 key topics identified by CAMA is provided below.

### **Theme 1: Weed control**

One of the main needs showed by farmers is to improve the strategies for weed control aiming at eliminating or minimizing the use of herbicides, also in relation to the presence of crop residues on the soil surface. Even the introduction of new and competitive cover crops with allelopathic characteristics, or the application of an adequate crop rotation strategy, is considered beneficial to decrease the dependence to the use of herbicides (see also theme 4). Furthermore, generally when the CA system is adopted, the composition of the weeds migrates towards the perennial ones and therefore, another need of farmers is represented by the introduction of new mechanical tools to manage this problem.

### **Theme 2: Seeding**

As also highlighted by the results of the online survey, the seeding phase in CA system is often perceived as a problem, particularly in relation to the availability/costs of adequate no-till machines. One of the main solutions that could encourage farmers to increase the level of adoption of CA is the presence of seeding machineries adapted to both soil and crop residues characteristics. Also availability of contracting services is considered an important element for NT adoption. In some Countries effective NT machineries are required to overcome limitation due to clayey soils.

### **Theme 3: Crop fertilization**

In general, the topic of crop fertilization was hardly addressed during the focus group discussions. In Italy, farmers showed specific needs concerning a) the development of application methods for manure and slurry in line with environmental rules in NT conditions and b) the identification of effective strategies of application

of fertilizers linked to crops and weather conditions. In Portugal farmers also stressed the importance of Precision Agriculture practices to enhance the benefit and performance of CA systems.

#### Theme 4: Crop rotation

Crop fertilization require adaptation to the different soil and climate characteristics. The experimentation of new crop rotation systems could increase the level of CA adoption, also in relation to the ability to increase soil fertility and gradually reduce the use of mineral fertilizers. Overall, the lack of market, advice and services for alternative crops is considered a relevant barrier to crop diversification. In all the cases, the impossibility to establish summer cover crops, or summer main crops, due to weather conditions and unavailability/costs of irrigation is perceived as a barrier to the implementation of full CA principles.

### 3. Country results

#### 3.1 Farmers' needs in Algeria

In Algeria the focus group was held online on 28/03/2022. It included the participation of one farmer adopting CA for 15 years on a crop rotation of durum wheat - fodder cropping (fodder pea, vetch) - legumes, and conventional system on a crop rotation of durum wheat - market gardening.

A summary of needs emerged during the focus group carried out in Algeria is reported in the following table.

Theme	Farmers' needs in Algeria
<b>Weed control</b>	<ul style="list-style-type: none"> <li>Weed control issues are particularly linked to the application of no-till technique, which leads to a simplification in terms of species that, however, tend to have a greater diffusion (e.g., <i>Veronica</i>, <i>Bromus</i>).</li> </ul>
<b>NT Seeding</b>	<ul style="list-style-type: none"> <li>The no-till technique increases problems of weed control. Not applicable in case of rotation with market gardening crops.</li> </ul>
<b>Crop fertilization</b>	<ul style="list-style-type: none"> <li><i>No specific issues emerged from the discussion</i></li> </ul>
<b>Crop rotation</b>	Obstacles to summer crop diversification are linked to: <ul style="list-style-type: none"> <li>the excessive drought, during the summer period, and difficult access to water for irrigation,</li> <li>lack of work force, especially during the harvesting periods.</li> </ul>

According to the needs summarized above, in Algeria the set of suggested technical improvements for the 4 themes can be referred to:

Theme 1: Weed control

- Strategies and tools for the control of *Veronica* and *Bromus*

Theme 2: Seeding

- Strategies for the cultivation of market-gardening crops according to CA principles

Theme 3: Crop fertilization

-

Theme 4: Crop rotation

- Strategies for anticipating installation of summer crops and cover crops (e.g., intercropping, overseeding)
- Testing drought-tolerant varieties for summer crops and cover crops

### 3.2 Farmers' needs in France

In France, the focus group was held on 26/09/2022, with 10 participants. 5 were farmers.

A summary of needs emerged during the focus group carried out in France is reported in the following table.

Theme	Farmers' needs in France
<b>Weed control</b>	<ul style="list-style-type: none"><li>• <i>No specific issues emerged</i></li></ul>
<b>NT Seeding</b>	<ul style="list-style-type: none"><li>• Knowledge about how to use and set direct sowing machines correctly is perceived as a crucial issue. There is a risk not to use the machinery properly, and thus a risk of a loss of income.</li><li>• Specialized advice is considered fundamental to support transition to CA as well as systems for peer-to-peer knowledge sharing among experienced farmers.</li><li>• Purchase of machineries is not perceived as a particular barrier, also in consideration of available cooperation mechanisms. Availability of adequate technologies can grow if CA becomes more common among farmers.</li></ul>
<b>Crop fertilization</b>	<ul style="list-style-type: none"><li>• <i>No specific issues emerged from the discussion</i></li></ul>
<b>Crop rotation</b>	<ul style="list-style-type: none"><li>• Crop rotation and diversification, also in view of introduction of summer covers crops, are particularly hampered by the dry summer conditions and the feasibility of irrigation (costs and availability).</li><li>• Availability of cover crop seeds: farmers demand for a more active market and a major support from training and advice services related to these novel crops.</li><li>• What is needed is the development of value chains for new crops, and cover crop variety seeds adapted to the pedo-climatic conditions, supplied</li></ul>

According to the needs summarized above, in France the set of suggested technical improvements for the 4 themes can be referred to:

Theme 1: Weed control

-

Theme 2: Seeding

- Evaluation of the effects of different settings on direct sowing machines

Theme 3: Crop fertilization

-

Theme 4: Crop rotation

- Strategies for anticipating installation of summer crops and cover crops (e.g., intercropping, overseeding)

### 3.3 Farmers' needs in Greece

In Greece two consecutive focus groups were held on 11/02/2022 in Drymos and 25/02/2022 in Volos, Thessaly. In total, 8 farmers, 3 researchers and 5 agronomists were involved. In both meetings there was an active participation of participants.

A summary of needs emerged during the focus group carried out in France is reported in the following table.

Theme	Farmers' needs in Greece
<b>Weed control</b>	<ul style="list-style-type: none"> <li>• Possible ban on glyphosate is perceived as a limiting factor.</li> <li>• Farmers who already adopt AC, by means of a dedicated crop rotation strategy, succeeded to eradicate the most important weed (<i>Lolium rigidum</i>) within 2-3 years, especially in the Drymos area.</li> </ul>
<b>NT Seeding</b>	<ul style="list-style-type: none"> <li>• The no-till technique is particularly hampered by soils that tend to compact. One solution could be the adoption of machinery (seeders) adapted to these contexts, or the application of strip tillage. Everyone is aware of the fact that a good use of cover crops could reduce the problem of soil compaction.</li> <li>• The cost and availability of no-till machinery negatively affects the spread of the no-till technique, together with limited after-sales service support for the replacement of broken parts and for adjustments, upgrading and refurbishing.</li> </ul>
<b>Crop fertilization</b>	<ul style="list-style-type: none"> <li>• No-till is identified as a crucial factor towards increased biological fertility. In addition, cover crops are identified as a significant tool to limit soil loss of fertility and wind erosion (strong winds in September-October months).</li> </ul>
<b>Crop rotation</b>	<ul style="list-style-type: none"> <li>• The scarcity of rainfall and the lack of irrigation water are the main causes that lead to a low use of cover crops.</li> <li>• Market barriers are relevant to crop diversification,</li> <li>• In areas specialized in specific crops (e.g. cotton) it is difficult to find the required infrastructure for crops which require specific post-harvest treatments,</li> <li>• Farmers are generally not used to implement rotations and even less inclined to test different rotations,</li> <li>• In many cases farmers lack information and knowledge about alternative options for rotation schemes is a limit (e.g. other crops, different rotation schemes etc.),</li> <li>• lack in cultivars and breeding material adapted to local pedoclimatic conditions.</li> </ul>

According to the needs summarized above, in Greece the set of suggested technical improvements for the 4 themes can be referred to:

Theme 1: Weed control

- Testing new strategies for weed control without glyphosate

Theme 2: Seeding

- Definition of appropriate strategies to avoid soil compaction in CA systems

Theme 3: Crop fertilization

-

Theme 4: Crop rotation

- Testing drought-tolerant varieties for summer crops and cover crops

### 3.4 Farmers' needs in Italy

In Italy, the focus group was carried out online on 27/12/2020 and involved a total of 10 participants, 6 of whom were farmers who already adopt conservation agriculture in the regions identified for the purposes of the project.

A summary of needs emerged during the focus group carried out in Italy is reported in the following table.

Theme	Farmers' needs in Italy
<b>Weed control</b>	<ul style="list-style-type: none"> <li>• Long run resistance management strategy</li> <li>• timing of intervention</li> <li>• alternatives to glyphosate</li> <li>• choosing the right cover crop</li> <li>• effective mechanical control of cover crops (to reduce herbicides)</li> </ul>
<b>NT Seeding</b>	<ul style="list-style-type: none"> <li>• soil compaction management</li> <li>• choice of the right sowing depth</li> <li>• Sowing elements adapted to the context in the field (clay, residue, moist soil, live cover crops)</li> <li>• Simple and cheap installation of cover crops</li> </ul>
<b>Crop fertilization</b>	<ul style="list-style-type: none"> <li>• opportunity to fertilize cover crops</li> <li>• manure and slurry pre-sowing and post sowing</li> <li>• typologies of fertilizers (granular / foliar fertilizer)</li> <li>• number of applications (one/multiple)</li> </ul>
<b>Crop rotation</b>	<ul style="list-style-type: none"> <li>• availability of seeds for alternative crops and cover crops</li> <li>• technical advice for alternative crops</li> <li>• cover crops sowing techniques (with seeder, with spreader, with distributing bars, in associations with crop and control of the cover crop)</li> </ul>

According to the needs summarized above, in Italy the set of suggested technical improvements for the 4 themes can be referred to:

Theme 1: Weed control

- Testing tools for mechanical control cover crops

Theme 2: Seeding

- Testing simple and cheap installation procedures of cover crops (open field distribution, overseeding etc)

Theme 3: Crop fertilization

- Testing new methods for manure and slurry application in line with environmental rules in NT conditions
- Application of CA-adapted N fertilization monitoring systems

Theme 4: Crop rotation

- Testing drought-tolerant varieties for summer crops and cover crops



### 3.5 Farmers' needs in Morocco

In Morocco two consecutive focus group were held, on February 2022 at the ONCA Regional Center in Rommani town, and on September 2022 in Zaer region. In total, 3 groups of farmers, 1 researcher and 2 representatives of National Extension services office and Bank of Crédit Agricole attended to the events. About farmers, some of them were no CA adopters, while the others had experience in CA since 2-10 years and 10-20 years.

A summary of needs emerged during the focus group carried out in Morocco is reported in the following table.

Theme	Farmers' needs in Morocco
<b>Weed control</b>	<ul style="list-style-type: none"> <li>Leaving the crop residues on the soil surface is a problem for weed control, but also for pests and diseases.</li> <li>At the beginning of the conversion to direct sowing the seed stock of weeds tends to emerge with great acuity due to the non-reshuffling of the soil and the non-burial of existing weed seeds.</li> <li>Need for an alternative way to the repeated use of plant protection products.</li> <li>Mechanical weeding requires labor that is becoming more and more expensive.</li> <li>The repeated use of plant protection products generates additional expenses</li> <li>The great diversity of weed stands hinders the processing operation and the choice of products to be applied in the CA</li> </ul>
<b>NT Seeding</b>	<ul style="list-style-type: none"> <li>Lack of NT machines and agricultural equipment required for the technique</li> <li>An increase of the number of the direct seeders could increase the level of adoption on no-till technique</li> </ul>
<b>Crop fertilization</b>	<ul style="list-style-type: none"> <li><i>No specific issues emerged from the discussion</i></li> </ul>
<b>Crop rotation</b>	<ul style="list-style-type: none"> <li>Problems related to crop residues and livestock. Farmers ask more subsidies for fodder, as alternative to leave the crop residues on the soil surface.</li> <li>Ensure proper rotations to control weeds and pathogens</li> </ul>

According to the needs summarized above, in Morocco the set of suggested technical improvements for the 4 themes can be referred to:

Theme 1: Weed control

- Testing tools/strategies for cheap control of weeds
- Testing tools/strategies for cheap control of crop residues

Theme 2: Seeding

-

Theme 3: Crop fertilization

-

Theme 4: Crop rotation

- Testing strategies for the effective coexistence of grazing and crop residues conservation

### 3.6 Farmers' needs in Portugal

In Portugal the focus group was held on 17/03/2022, via Skype. It was attended by 6 farmers, whose majority was from Alentejo region, South of Portugal. All of them already were CA adopters, and their experience in CA ranged between 5 and 25 years. They generally cultivate winter crops (cereals and legumes), maize and sunflower as summer crops. Forage for those who are also breeder.

A summary of needs emerged during the focus group carried out in Portugal is reported in the following table.

Theme	Farmers' needs in Portugal
<b>Weed control</b>	<ul style="list-style-type: none"> <li>The technology/technical know-how (e.g. type of treatments, herbicides) changes with the CA</li> <li>Choosing the most appropriate, affordable, and available cover crops</li> </ul>
<b>NT Seeding</b>	<ul style="list-style-type: none"> <li>Conflict between crop residues/livestock/trampling of livestock</li> <li>Corn cob residues can be a problem</li> <li>It is necessary to adapt the Conservation Agriculture practices to different soils and production systems</li> <li>Availability of contracting services is a limit</li> </ul>
<b>Crop fertilization</b>	<ul style="list-style-type: none"> <li>Precision Agriculture practices are required in Conservation Agriculture</li> <li>There are advantages of the cover crop in the amount of soil OM increase, in the availability of nitrogen (when the cover crop is leguminous)</li> </ul>
<b>Crop rotation</b>	<ul style="list-style-type: none"> <li>Cover crops are installed in winter because in summer they are unviable. Currently, species other than grasses that are more efficient in the use of water are being evaluated, such as brassicas.</li> <li>Advice on the choices of species to be considered in rotations is needed</li> <li>The costs of cover crop (seed) are high</li> <li>Lack of market for some alternative crops</li> </ul>

According to the needs summarized above, in Portugal the set of suggested technical improvements for the 4 themes can be referred to:

Theme 1: Weed control

- Testing cover crops effective strategies to control weeds

Theme 2: Seeding

- Testing strategies for effective management of corn residues

Theme 3: Crop fertilization

-

Theme 4: Crop rotation

- Strategies for anticipating installation of summer crops and cover crops (e.g., intercropping, overseeding)

### 3.7 Farmers' needs in Spain

In Spain the focus group was held on 05/04/2022, via Skype. The online meeting was attended only by technicians on behalf of farmers.

A summary of needs emerged during the focus group carried out in Spain is reported in the following table.

Theme	Farmers' needs
<b>Weed control</b>	<ul style="list-style-type: none"> <li>The integration of the three principles of CA, for 4/5 years, could increase the level of knowledge about weed pressure.</li> <li>An increase of sharing of experiences among farmers could increase their knowledge about weed control, and then the level of adoption of CA.</li> </ul>
<b>NT Seeding</b>	<ul style="list-style-type: none"> <li>availability of machinery and the fear/lack of confidence of unknown problems and how to overcome them.</li> <li>A greater presence of machinery service companies (contractors) could overcome the low adoption of no-tillage in Spain and, in particular, in Galicia region, where farms are smaller than other regions and farmers are not able to sustain the high cost of machinery.</li> <li>training and advice services and farmers associations could increase the level of adoption of CA, and then knowledge about no-till seeding. It is necessary to adapt the Conservation Agriculture practices to different soils and production systems</li> </ul>
<b>Crop fertilization</b>	<ul style="list-style-type: none"> <li><i>No specific issues emerged from the discussion</i></li> </ul>
<b>Crop rotation</b>	<ul style="list-style-type: none"> <li>A more active market to promote crop diversification and crop rotation.</li> <li>There is a need of new less water-demanding cover crops, to overcome the problems related to the costs of irrigation for summer cover crops, especially in South of Spain.</li> <li>Strengthening of training and advice services and farmers associations could increase the level of adoption of CA, and then knowledge about crop rotation and diversification.</li> </ul>

According to the needs summarized above, in Spain the set of suggested technical improvements for the 4 themes can be referred to:

Theme 4: Crop rotation

- Strategies for anticipating installation of summer crops and cover crops (e.g., intercropping, overseeding)
- Testing drought-tolerant varieties for summer crops and cover crops

### 3.8 Farmers' needs in Tunisia

In Tunisia the focus group was held on 22/09/2022 and attended by 6 farmers and 2 researchers.

A summary of needs emerged during the focus is reported in the following table.

Theme	Farmers' needs in Tunisia
<b>Weed control</b>	<ul style="list-style-type: none"> <li>• <i>No specific issues emerged from the discussion</i></li> </ul>
<b>NT Seeding</b>	<ul style="list-style-type: none"> <li>• The no-tillage technique application is severally hindered by the clay soil, and then soil compaction. Causes can be found in the lack of crop rotation and cultivation of species with deep roots. They ask major knowledge about how to improve with the correct application of CA system.</li> <li>• The application of NT seeding is limited by the lack of contractors of machinery and the cost more than double for no-till seeder than conventional one. Farmers ask national financial aids to support the purchase of machinery and in general to support CA system.</li> <li>• Develop and commercialize locally produced zero-tillage seeders</li> </ul>
<b>Crop fertilization</b>	<ul style="list-style-type: none"> <li>• <i>No specific issues emerged from the discussion</i></li> </ul>
<b>Crop rotation</b>	<ul style="list-style-type: none"> <li>• The application of crop rotation and diversification is very limited because of the high variability of prices of other crops than cereals (the price of cereals is fixed by the government).</li> <li>• high variability of precipitation among years leads farmers not to cultivate legumes.</li> <li>• The cultivation of cover crops is also hindered by the lack of adequate machinery.</li> <li>• limited species can be used as cover crops, especially during summer period</li> <li>• Some farmers report difficulties in establishing legume crops under NT</li> <li>• Develop new promising forage species and forage crops mixtures adapted in several agroecological zones</li> </ul>

According to the needs summarized above, in Tunisia the set of suggested technical improvements for the 4 themes can be referred to:

Theme 1: Weed control

-

Theme 2: Seeding

- Testing best crop rotation for clayey soil structuring

Theme 3: Crop fertilization

-

Theme 4: Crop rotation

- Strategies for anticipating installation of summer crops and cover crops (e.g., intercropping, overseeding)
- Testing drought-tolerant varieties for summer crops and cover crops