



# Magic

Marginal lands for Growing Industrial Crops

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## **1. Publishable executive summary**

The MAGIC project aims to promote the sustainable development of efficient and beneficial industrial crops on marginal lands. A database and a crop support system have been developed, including detailed agricultural information to be of great use to farmers.

In addition, marginal lands in Europe have also been analysed and several optimal crops have been proposed with the aim of developing sustainable best practice options for industrial crops. The impact of MAGIC has been maximised by integrating the sustainability aspects (encompassing environment, society, and economy) of value chains.

Work Package 8 - Dissemination and link establishment with EIP AGRI, seeks to propagate the project results, database, maps and DSS tool in order to enhance farmers' knowledge, plus creating strong links with EIP AGRI.

The aim of this paper is to present the content of the national workshops and demo days that were performed during the MAGIC project. The seminars and conferences show how all the countries channelised all the information obtained in the project to final users while the field visits were a unique opportunity to get first-hand information about crops, machinery or final products features. This action was proposed with the main objective of spreading the knowledge acquired from MAGIC.

The countries that participated were France, Germany, Greece, Italy, Latvia, Poland, Portugal, Spain, and Ukraine.

## 2. Introduction

MAGIC's national workshops and demo days aimed to spread the knowledge acquired within the project as much as possible. In this line, MAGIC's tools (MAPS, CROPS, DSS and Bio2Match) were presented together with the numerous factsheets created during the project life. Some demo days were also organised to present in detail machinery aspects regarding the harvest and baling and also about the crops and the quality of the resultant biomass.

Even if the events were initially planned to be held in a face-to-face mode, most of the workshops had to be finally conducted in an online format due to the COVID restrictions. However, since some of them were executed earlier and before the pandemic, they were accomplished in a face-to-face modality. Given the circumstances, some countries offered a hybrid mode, where the assistants could attend via internet or in person, in order to increase the attendance rate as much as possible.

All the entities involved in this task (covering a total of nine countries) carried out at least one workshop and/or demo day, while others were able to perform several. In this sense, farmers, industry representatives, scientists, and other interested stakeholders were invited to join all of them.

The national workshops and demo days are presented following by country. A strong collaboration among MAGIC partners was held in order to attain these outcomes.

### 3. National workshops and demo days

#### 3.1 France

Novabiom organized a national workshop on January 6<sup>th</sup>, 2022, targeting in particular miscanthus growers in France, with the help of INRAE/AgroParisTech to present the MAGIC tools and their principles. The meeting was held on-line due to the COVID-19 pandemic.

Participants included: Alexandra Dutay (Novabiom), Caroline Wathy (Novabiom), Sarah Bossez (France Miscanthus – an association of miscanthus growers), Emmanuel de Maupeou (Novabiom), and Benoit Gabrielle (AgroParisTech/INRAE).

The meeting agenda was set on the following bullet points:

- A round of introduction
- An overview of the MAGIC project, concepts, and principles of its tools
- A demonstration of MAGIC tools:
  - MAGIC-Crops
  - MAGIC-Maps
  - MAGIC-DSS
  - Bio2Match tool
  - Logistics modelling (only the methodology and case-study results were presented)

Feedback and comments from the participants:

- Overall, the demonstration generated a high level of interest for the development of miscanthus in France in particular. The novelty of the results presented in the tools (the maps in particular) was stressed as a very positive and relevant innovation. There was a general focus on miscanthus since the growers present at the meeting were specialized in this crop, although one participant acknowledged that the tools were similarly useful for other industrial crops.
- Regarding MAGIC CROPS: the sensitivity scores to marginal constraints (pH, salinity etc...) were deemed very useful to estimate the impacts of marginality factors on crop yield. The values proposed in the tool were validated by the participants, except the 'shallow soil' criteria with a threshold depth (35 cm) which appeared unfavorable to miscanthus.
- The high resolution (at municipality level) of MAGIC-MAPS was appreciated and deemed relevant to provide guidance in the location of future miscanthus plots or value-chains
- Conversely, the participants were concerned (and surprised) that the same level of resolution was not used with the MAGIC-DSS tool. The latter has the advantage of factoring in suitability factors for the 20 "MAGIC crops" (including miscanthus), but the fact that it aggregates results at the NUTS3 ("Département") level made it less relevant to decision making. Scaling down MAGIC-DSS to the resolution offered in MAGIC-MAPS was recommended by the miscanthus growers.

- The participants were impressed by the range of feedstocks, conversion processes and end-uses covered by the Bio2Match tool. They were interested to see which characteristics of miscanthus made it unsuitable for some processes (e.g., standard anaerobic digestion), and how these barriers could be overcome by pre-treatments (an option offered by the tool).
- Although the workshop involved a limited audience, it was suggested that the MAGIC project and tools be presented to a wider circle of miscanthus growers during the next board meeting of the 'France miscanthus' organization - an organization dedicated to the development of this crop in France. Further feedback will be collected by then and will be passed on to the teams maintaining the MAGIC tools.

### 3.2 Germany

UHOH carried out a national workshop in December 2021, dedicated to the farmers and the industry. Due to the pandemic situation, the workshop was not a one-off event, but it was conducted with selected persons in direct communication via telephone and Zoom (n = 10). Furthermore, the link to MAGIC DSS as well as an excerpt from the guidelines for farmers (calendula and hemp) translated into German was sent by email to over one hundred German farmers and biogas plant operators. The comments taken from this interactive national workshop were communicated to the project partners in WP2 so that it could be used to optimize MAGIC DSS.

The MAGIC DSS tool received mostly positive feedback regarding its usefulness, but there were also numerous suggestions for improving its usability and comprehensibility:

- **Regarding the usability**, all respondents missed some guidelines describing how to use the tool. It was also mentioned that the page took a long time to load, which could be remedied by reducing the number of animated display fields. Some respondents also noticed that the crop-specific numbers of suitable acreage on marginal land do not update when individual countries or regions are selected. It was also noted that the acreage of industrial crops in the drop-down list after clicking on a region does not refer to the area of marginal land but to the total area. Therefore, changes in the code have to be made in order to display the correct acreage values.
- **Regarding comprehensibility**, many participants were not familiar with the English language and therefore missed a translation button to change the language of the MAGIC DSS tool to German. Additionally, other participants missed the ability to select other industrial crops besides Miscanthus and Switchgrass. It was also unclear to most respondents what the many abbreviations stood for, and it could be clarified with the above-mentioned operating instructions. The information presented on marginal cropping conditions was found to be accurate and understandable.

The excerpt from the guidelines for farmers translated into German received mostly positive feedback and no significant suggestions for improvement. There were found to be extremely helpful in providing an initial overview of cultivation practices for industrial crops. The results concluded that the contents of the tool are valuable, but the surface/programming still needs to be optimized.

### 3.3 Italy

Italian partners conducted a hybrid workshop on September 6, 2021, due to de COVID restrictions. The event had a duration of three hours, from 9.00 h to 12.00 h.

The event (see *Figure 1*) consisted of six oral presentations reporting the main findings of different WPs of MAGIC. The workshop was jointly organized by UNIBO, CREA and CRES. It was held at the Department of Agricultural and Food Sciences at Bologna, Viale G. Fanin 44, Bologna, Italy.



Figure 1. Presentation at the Italian national workshop. *Source: UNIBO, 2021.*

About 60 participants attended the conference, with 25 people in the room and 35 connected online (see *Figure 2*).



Figure 2. Picture of the audience at the Italian national workshop. *Source: UNIBO, 2021.*

Firstly, Mrs. Efthymia Alexopoulou, (CRES, MAGIC project coordinator) briefly introduced the project. Then, Francesco Pancaldi (UW) explained the development of genetic tools for rapid improvement of orphan biomass crops for marginal lands. Later, there was an overview of industrial crops on European marginal lands conducted by Danilo Scordia (UNICT).

Hereafter, Eleni Papazoglou (AUA) described the utilization of industrial crops for the phytomanagement and remediation of heavy metal contaminated soils. This was followed by the explanation of Nils Rettenmaier (IFEU) on integrated sustainability assessment of selected products from marginal land. After this, Lazaros Karaoglanoglou (AUA) explained the biomass production on marginal land with particular attention to mapping the economic feasibility prospects for multiple value chain.

Finally, there was a wrap up session where the participants were given the opportunity to interact with the MAGIC partners present at the event.

There were several results and conclusions extracted from this event:

- Most of the marginal land in Italy is characterized by adverse terrain conditions, and in Central Italy, where Bologna is located, by steep slope.
- In Italy, marginal land is often grown with crops with low profitability, such as barley or sunflower, so the industrial crops should demonstrate a certain profitability against those crops and could represent an alternative to them to put in rotation, particularly when dealing with annual species.
- Farmers look for the possibility to keep rotating their main crops with industrial crops to maintain the soils healthy but still economically sustainable. Accomplishing this task implies the possibility to use the same machineries for all phases involved in the cropping, from sowing to harvesting, otherwise, further investments to upgrade the fleet are unavoidable with a negative impact on the net income of the enterprises.
- Investigating the mechanical suitability of already-available machineries is crucial to integrate industrial crops cultivation to the European panorama of agriculture.
- Camelina was found particularly suitable for cultivation in steep soil (approximately 15%) not only for the high seed yield recorded but also extremely limited seed loss found during the mechanical harvesting which was as low as reported in similar studies performed in flat fields.
- It was considered the possibility to anticipate the harvesting of camelina by applying the swathing method. Swathing is a simple but effective technique consisting of mowing the crop as soon as the oil content in seeds picks and let the sun dry it naturally. Afterwards, threshing is performed through combine harvesting to collect the seeds. Such practice can help to anticipate the sowing of the next crop by 1 or 2 weeks according to the weather conditions.

### 3.4 Latvia

LSFRI SILAVA organised a national workshop for Latvian Rural Advisory and Training Centre. It took part the 26<sup>th</sup> of October 2021, from 10:00 to 11:00 (see *Figure 3*). The main objective was to act interactive, validate MAGIC-CROPS and test MAGIC-DSS.

The Latvian Rural Advisory and Training Centre is an organisation providing consultancy services related to rural development in Latvia. The consultants provide advice and services related to industry production processes, accounting and business planning to rural entrepreneurs, organisations, and population, as well as to conduct studies, educate and inform. The clients of the centre are representatives of different social groups of the rural population. Consultations are demanded by employees in agriculture, forestry, fisheries, and other rural business fields. Therefore, the trained consultants are key actors of transferring innovations from the academic and scientific sector to the professionals of the agricultural sector in Latvia. Also, researchers of Latvian State Forest Research Institute SILAVA were invited to present results of ongoing projects.







Valsts Lauku tīkla Sekretariāta ietvaros rīkots  
**Tiešsaistes seminārs**  
**“Jaunrades projektu aktualitātes mežsaimniecībā”**

Norises vieta: tiešsaistē ZOOM platformā

Datums un laiks: 2021. gada 30.jūnijs, plkst. 10:00

Laiks	Tēma	Lektors
10:00-10:20	Rezultāti no projekta "Daudzfunkcionālas pacilu veidošanas iekārtas izstrādāšana meža atjaunošanai izcirtumos uz auglīgām un pārmitrām augsnēm", kas tiek īstenots LAP 2014.-2020.gadam pasākuma 16. "Sadarbība" 16.2. apakšpasākumā: "Atbalsts jaunu produktu, metožu, procesu un tehnoloģiju izstrādei", projekts Nr.18-00A01620-000035	Dagnija Lazdiņa un Kristaps Makovskis
10:20-10:40	Par bioekonomiku izmantojamie izglītošanas materiāli un resursi no projekta "Biomateriālu izmantošanas stratēģijas un ceļveži ES lauku un reģionālās attīstības uzlabošanai (BE-Rural)" Horizon 2020 Research and innovation Programme under Granta līgums No 818478.	Dagnija Lazdiņa un Austra Zuševica
10:40-11:00	Pirmie rezultāti no laboratorijas izmēģinājumiem projektā "Jaunas tehnoloģijas izstrāde augu mēslošanas līdzekļu ražošanai no biogāzes ražotnes fermentācijas atliekām – digestāta un šķeldas koģenerācijas atliekām – koksnes pelniem" kas tiek īstenots LAP 2014.-2020.gadam pasākuma 16. "Sadarbība" 16.1.apakšpasākumā "Atbalsts Eiropas Inovāciju partnerības lauksaimniecības ražīgumam un ilgtspējai lauksaimniecības ražīguma un ilgtspējas darba grupu projektu īstenošanai" ietvaros, projekts Nr.19-00-A01612-000008	Dagnija Lazdina un Kārlis Dūmiņš

Valsts Lauku tīkla Sekretariāta vadītājs: / Edgars Linde

VLT Sekretariāta projektu vadītāja: /Aiva Saulīte-Liniņa

Saskaņā ar Latvijas Republikas Zemkopības ministrijas un SIA „Latvijas Lauku konsultāciju un izglītības centrs” noslēgto līgumu nr. 2021/7 no 2021.gada 19.janvāra  
ATBALSTA ZEMKOPĪBAS MINISTRIJA UN LAUKU ATBALSTA DIENESTS

Figure 3: Programme of the Latvian national workshop. Source: SILAVA, 2021.

The MAGIC-DSS and the guidelines for farmers, developed by MAGIC team, were presented during an online meeting (see Figure 4). Later consultants worked as multipliers in dissemination of information about MAGIC products. This was done during national



<b>Non Food Crops as a source of energy and high-value products</b>		
<b>Demo days</b>		
<b>23-24/09/2020</b>		
<b>Place: Olsztyn, Pasym, Łęczany</b>		
<b>23<sup>rd</sup> of September – Day 1</b>		
Hour	Item	Lecturer
13:30	Visiting the plant of a biomass producer for energy purposes - Quercus sp. z o.o, ul. Jana Pawła II 21, 12-130 Pasym	Quercus's representative, Mariusz Stolarski
15:00	Travelling to Olsztyn	
15:30	Lunch	
16:15	Presentation of Panacea project	Michał Krzyżaniak
16:30	Examples of research on the multidirectional use of industrial plants, carried out at the University of Warmia and Mazury in Olsztyn	Mariusz Stolarski, Michał Krzyżaniak
16:45	Presentation of biomass quality assessment and biomass bioconversion laboratories	Mariusz Stolarski, Michał Krzyżaniak
17:15	Travelling to the hotel and accommodation	
18:30	Dinner - restaurant in the centre of Olsztyn	
<b>24<sup>th</sup> of September – Day 2</b>		
Hour	Item	Lecturer
9:00	Departure to Zakład Produkcyjno-Doświadczalny "Łęczany" sp. z o.o., Łęczany 15, 11-440 Reszel (large commercial farm)	
10:00	Presentation of the farm	Józef Jurek, president of the board
10:30	Visiting of experimental fields of crops for energy and industrial purposes	Mariusz Stolarski, Michał Krzyżaniak
14:00	Lunch	
15:00	Travelling to Olsztyn	
16:00	Presentation of Magic project	Michał Krzyżaniak
17:00	Summary of the workshop	Michał Krzyżaniak, Mariusz Stolarski
18:00	Dinner in the hotel	
<p>Contact for registration: Michał Krzyżaniak <a href="mailto:biowarmia.olsztyn@gmail.com">biowarmia.olsztyn@gmail.com</a> tel. +48 660 632 180 Please register until September 16<sup>th</sup>, 2020. The number of places is limited.</p>		

Figure 5: Programme of the Polish national workshop. *Source: 3B, 2021.*

The training was organized as part of PANACEA and MAGIC projects, funded in Horizon 2020. During the event, the biomass production and logistics plant (*Quercus Ltd.*), one of the largest in north-eastern Poland, was visited (see *Figure 6*). The Quercus company supplies biomass for plants producing electricity and heat even within a radius of 250 km. The company is able to process harvest residues into wood chips or bales and has a highly specialized and modern fleet for the transport of bulk materials, bales, and universal loading

units. Its own railway siding enables the supply of biomass to customers also by rail. The company can deliver up to 4,000 tons of biomass per week, and even 200,000 tons per year.



Figure 6: Quercus Ltd. farming field visit in Poland. *Source: 3B, 2021.*

On the same day, the biomass quality assessment and bioconversion laboratories were visited (see *Figure 7*), where the participants learned what and how to analyse the biomass features of non-food crops (e.g., humidity, heat of combustion, ash, elemental composition).



Figure 7: Visit to biomass laboratory facilities in Poland. *Source: 3B, 2021.*

On the second day of the training, participants visited a large-scale farm (Zakład Produkcyjno-Doświadczalny "Łężany" Ltd.), which conducts commercial production of willow grown in 3 - 4-year harvest rotations (see *Figure 8*). There are also experimental fields of non-food crops on the farm. For example, giant miscanthus, Virginia mallow and willow leaf sunflower grown on sandy soil and fertilized with mineral fertilizers and digestate from biogas plants yielded from 3 to 9 t/ha/year dry matter. The plantations of willow cultivated in 7-year rotations on marginal soils (sand and clay soils) were also visited.



Figure 8: Visit to a biomass production plant in Poland. *Source: 3B, 2021.*

### 3.6 Portugal

Four national workshops were organized in total in Portugal: one on industrial crops adapted to arid lands, two on the use of industrial crops cultivated in marginal soils for bioenergy and biorefineries, and the last one on prospects of bioenergy.

In all of them, the MAGIC project was presented and also different industrial crops, including cultivation aspects, logistics and processing options. In addition, constraints and opportunities of their cultivation in marginal soils were identified. Different value chains were presented, namely the production of bionanocomposites for food packaging, construction materials, and bioenergy, bioproducts and biofuels production (renewable and low-carbon fuels, including hydrogen, for sectors that are hard to decarbonise). Environmental, economic and socio-economic issues associated with the different value chains were equally exposed.

Several challenges were observed: how to meet the heavy industry's low carbon fuel needs, given that the production of energy crops in marginal lands, in Portugal, is very low, and how it will be possible to increase the availability of low indirect land-use change-risk biofuels, bioliquids and biomass fuels. It was agreed that for the development of consistent value chains it will be needed more research, investments in technologies that allows the scale up of the processes and policy and financial incentives (linked with bioeconomy). Furthermore, it was concluded that more dissemination and training events to farmers on the opportunities driven by the cultivation of industrial crops in marginal soils is needed.

Regarding the workshop held on April 17, 2019, organized by FCT UNL over the Campus Caparica (Caparica, Portugal), titled "Exploiting unproductive arid lands" (see *Figure 9*), this workshop was organized in collaboration with PANACEA project (funded by H2020) and MediOpuntia project (funded by ERANETMED) and focused on promising crops particularly adapted to arid lands and severely degraded soils that are unsuitable for traditional crops.

The aim of this workshop was to present strategies towards the establishment of some industrial crops in dry marginal lands of the Mediterranean. It was foreseen to provide demonstration of the use of those crops, adding value to the final product, e.g., as feedstock

for bioproducts, biomaterials or bioenergy. Promising crops particularly adapted to arid lands were presented, e.g., giant reed, cardoon. Fifty participants were present, including farmers and representatives from cooperatives, industry, regulatory bodies and policy makers, and researchers.

During this event there were discussed the opportunities of lignocellulosic, carbohydrate and other industrial crops for the agricultural sector. Different strengths were identified in different industrial crops (giant reed, cardoon), namely, its tolerance to degraded soils and to limited availability of water resources.

Different opportunities were identified for the cultivation of some of the industrial crops in arid soils, through the development of more sustainable irrigation systems and the use of wastewaters in irrigation; also, different harvesting systems adapted to certain types of marginal soils. Similarly, several opportunities were identified to add value to some of these crops, specifically the production of bionanocomposites for food packaging, besides the common application for bioenergy and biofuels. Moreover, its production, either for bioenergy or biomaterials, offers environmental advantages, by contributing to the reduction of greenhouse gases and energy savings, helping to combat climate change, and social benefits, especially in rural areas. In addition, the establishment of dedicated energy crops on marginal land, avoids land-use conflicts due to competition for food and feed.

It was noted that yields and biomass quality can be affected by the soil marginality, reducing the environmental savings and compromising its economic exploitation.



Figure 9. Presentation at the 1<sup>st</sup> Portuguese national workshop. *Source: FCT UNL, 2022.*

On the other hand, on November 27, 2019, and January 7, 2020, two workshops were organized by FCT UNL titled “Biorefineries and Bioenergy” over the Caparica’s Campus (see *Figure 10*) and Guimarães (see *Figure 11*), respectively.



Figure 10. Presentation at the 2<sup>nd</sup> Portuguese national workshop. *Source: FCT UNL, 2022.*

These national workshops focused on opportunities driven from the use of biomass from marginal soils to bioenergy and in biorefineries. Twenty-six participants were present at the Caparica's event and nineteen over Guimarães one, including farmers, cooperatives, industry, regulatory bodies and policy makers, and researchers.



Figure 11. Presentation at the 3<sup>rd</sup> Portuguese national workshop. *Source: FCT UNL, 2022.*

During these events, the opportunities of producing industrial crops, namely lignocellulosic crops, in marginal lands and its importance for the agricultural sector were discussed. Different strengths were identified over the sustainability of the value chains in the use of biomass for bioenergy, biofuels and bioproducts, such as the biodegradability, renewability, reduction to fossil feedstock dependence or the reduction of Greenhouse Gases emissions.

Finally, on November 26, 2020, the fourth Portuguese national workshop was organized by FCT UNL in an online format (see *Figure 12*), due to COVID-19 pandemic, and titled "Prospects of Bioenergy in Portugal". In this national workshop a special focus was given to the dissemination of the tools developed under the MAGIC project at that time, namely

MAGIC-CROPS, MAGIC-MAPS and MAGIC-DSS. This webinar was also streamed with Brazil.

A total of fifty-four participants were connected online. During this event it was discussed the opportunities and constraints of producing industrial crops in marginal lands and its importance for the agricultural sector. After the webinar a follow-up on the use of the MAGIC project tools was made. From the 54 attendees, only 30% answered, indicating that the tools allowed them to know better which industrial crops could be of use for their own interests (farmers and industrials).

The main outcome of the organization of all these events was the partnership and consortiums that were established among industrials, municipal authorities and cooperatives for planning future collaborations and projects in the field of bioenergy and bioeconomy.



**Webinar:**  
**Bioenergia em Portugal**  
**Oportunidades e Desafios**

**Mediador:**  
**Prof. Dr. Fernando Santos**

**FCT**  
FACULDADE DE CIÊNCIAS E TECNOLOGIA  
UNIVERSIDADE NOVA DE LISBOA

**26/11**  
**14h**

Participe através do nosso canal no YouTube  
<https://www.youtube.com/channel/UCjDYcgASx9ixXHbrHCbrV0A>

**AO VIVO NO CANAL**  
BSS Biorefinery Sustainable Solutions  
YouTube

**Convidadas:**

**Tecnologias Sustentáveis para a Produção de Biomassa e Bioenergia**  
**Prof. Dra. Ana Luisa Fernando**  
Professora Associada na Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Portugal. Investigadora do MEIRICs, Centro de Engenharia Mecânica e de Sustentabilidade de Recursos, Universidade do Minho e Universidade NOVA de Lisboa. Coordenadora do Doutoramento em Bioenergia.

**Biomassa & Bioenergia - Inovação, Formação e Cooperação**  
**Prof. Dra. Maria Margarida Gonçalves**  
Professora Auxiliar na Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa. Investigadora do MEIRICs - Centro de Engenharia Mecânica e de Sustentabilidade de Recursos. Colaboradora do VALORIZA - Centro de Investigação para Valorização de Recursos Endógenos. Coordenadora do Mestrado em Bioenergia.

Figure 12. Program of the 4<sup>th</sup> Portuguese national workshop. Source: FCT UNL, 2022.

### 3.7 Spain

In Spain, CIEMAT and Spanish Co-ops (MAGIC project Spanish partners) have worked together to arrange the national workshop in a coordinated way. Given the restrictions caused by COVID-19 pandemic, it was decided to divide the event in two different online sessions: a webinar and a virtual demo day. In this sense, the conference was titled “New crops for low productivity areas” and the virtual field visit “Demonstration of industrial crops and harvesting of perennials”. Both sessions are described below.

### **Webinar/Virtual conference: “New crops for low productivity areas”**

This event (see *Figure 13*), organised in close collaboration between CIEMAT, Wageningen University and Spanish Co-ops, took place on October 13, 2020, at 16:00 h in online format due to the pandemic situation. The conference responded to the need to provide cooperatives and their farmers with new crop alternatives to achieve greater diversification and profitability of their members' farms. For this purpose, MAGIC project results were considered to be very valuable. The invitation was extended to a wide number of research organisations, cooperatives, policy makers, etc. Some 40 participants were present at the event (online).

In addition, taking advantage of the involvement of Spanish Co-ops in two MAGIC-related EU H2020 funded projects, PANACEA: “A thematic network to design the penetration PATH of Non-food Agricultural Crops into European Agriculture” and 4CE-MED: “Camelina: a Cash Cover Crop Enhancing water and soil conservation in MEDiterranean dry-farming systems”, relevant stakeholders with experience in industrial crops were invited to this workshop as speakers but also as participative audience. The aim of PANACEA project (finished in March 2021) was to disseminate applicable cases of non-food crops close to the market reality, increasing the contribution of non-food crops to the European Bio-economy Strategy. 4CE-MED (ongoing) aims to identify socio-economic and technical barriers as well as opportunities for the adoption of conservation agriculture in the Mediterranean basin. To this end, camelina will be tested under real conditions as a commercial cover crop, adopting effective double cropping systems suitable for different environmental conditions

The seminar was opened by Paz Fentes, deputy director general of Arable and Industrial Crops and Olive Oil of the Spanish Agricultural Ministry (MAPA), who stressed the need to work for the diversification of farms. According to Fentes, emerging crops will make it possible to recover production from the past that is very appropriate for the current situation, to tackle our vegetable protein deficit and to respond to the environmental demands proposed by the Commission in the future CAP. Paz Fentes stressed that the role of the cooperatives is essential for them to guide and advise their members on the alternative that these crops represent.

Pablo Fernández, a technician of Spanish Co-ops, moderated the webinar and explained that the objective of the conference was to disseminate the results of the European projects MAGIC, PANACEA and 4CE-MED, in order to foster the implementation of industrial crops on land with low productivity, increasing the diversification and profitability of farmers' farms, taking advantage of the new markets that are emerging within the framework of the bioeconomy.

Furthermore, Berien Elbersen, from Wageningen University, presented the work carried out through the MAGIC project, which has mapped marginal areas in Europe based on the analysis of factors such as climate, humidity, fertility and chemical properties of the soil, rooting capacity and soil conditions.

**9 PANACEA** **Magic** **4CE MED**  
WATER AND SOIL CONSERVATION

## NUEVOS CULTIVOS PARA ZONAS DE BAJA PRODUCTIVIDAD

Seminario Web

**cooperativas agro-alimentarias España** **13 OCTUBRE 16:00h**

### PROGRAMA

**16:00 Inauguración de la jornada.**  
Paz Fentes. Subdirectora General de Cultivos Herbáceos e Industriales y Aceite de Oliva. Ministerio de Agricultura, Pesca y Alimentación (MAPA).

**16:15 Zonificación de superficies agrícolas marginales en España.**  
Berien Elbersen. Investigadora senior del uso de la tierra y evaluación ambiental integrada. Wageningen University & Research.

**16:45 Alternativas de cultivo para tierras marginales.**  
Pilar Ciria. Responsable del área de producción de biomasa. Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas (CIEMAT).

**17:15 Camelina: Oportunidades agronómicas y de mercado.**  
Anibal Capuano. Director Técnico. Camelina Company España.

**17:30 Experiencia en Alcamancha S.C., visión y conclusiones**  
Juan Carlos Bermejo. Presidente de Cultivos Herbáceos. Cooperativas Agro-alimentarias de España.

**17:45 Clausura.**  
Lorena Ruiz. Responsable Negocio Agroalimentario. Banco Santander

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**INAUGURACIÓN Y CLAUSURA**

<b>PAZ FENTES</b> MAPA	<b>LORENA RUIZ</b> SANTANDER AGRO	<b>PABLO FERNÁNDEZ</b> COOPERATIVAS AGRO-ALIMENTARIAS ESPAÑA

**MODERADOR**

**PONENTES**

<b>BERIEN ELBERSEN</b> WAGENINGEN U&R	<b>PILAR CIRIA</b> CIEMAT	<b>JUAN CARLOS BERMEJO</b> COOPERATIVAS AGRO-ALIMENTARIAS ESPAÑA	<b>ANIBAL CAPUANO</b> CAMELINA COMPANY

**INSCRÍBETE**

Patrocina: **Santander Agro**

Estos proyectos han recibido financiación del programa de investigación e innovación de la Unión Europea Horizonte 2020 bajo el acuerdo de subvención N.773501 (PANACEA), N.727508 (MAGIC), N.1911 (4CE-MED)

Figure 13: Programme of the Spanish webinar. Source: Spanish Co-ops, 2020.

This mapping has shown that 60% of the agricultural area in Spain is marginal (see *Figure 14* and *Figure 15*) and, therefore, to achieve farm profitability it will be necessary to grow other crops that also generate environmental services.

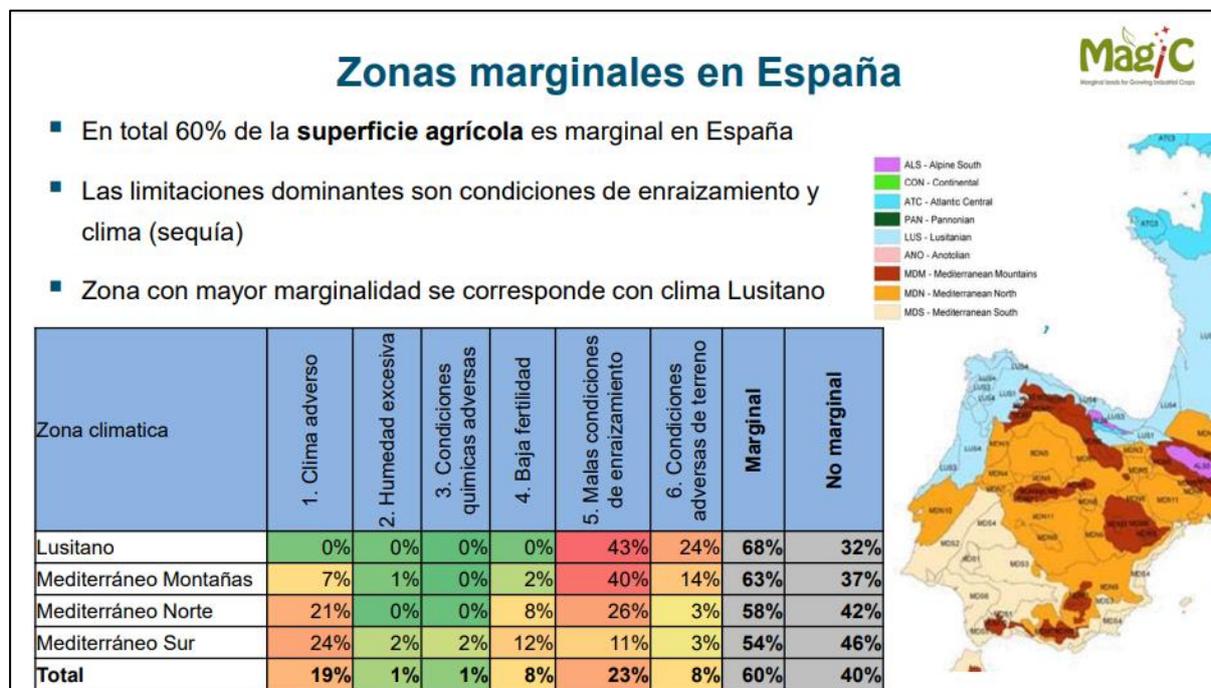


Figure 14: Classification of marginal lands in Spain. Source: WU, 2020.

By the other hand, Pilar Ciria, from CEDER-CIEMAT, presented some crop alternatives for marginal lands such as elm, wheatgrass, thistle, nicotiana, cane, *Brassica carinata*, hemp, flax and safflower, which are adapted to adverse conditions and can produce bioproducts and biofuels.

One of the crops that has been introduced in recent years in Spain is camelina. Aníbal Capuano from Camelina Company España explained its characteristics, highlighting its resistance to diseases and pests, as well as its good tolerance to drought and its allelopathic effect. So far, a total of 40,000 hectares have been dedicated to this crop, from which oil and flour are obtained.

To learn about a more local experience, Juan Carlos Bermejo, president of the Herbaceous Sector Council and manager of the Cereales Alcamancha cooperative, described the experience they have carried out with the introduction of new crops such as camelina and lavandin, with which they aim to improve the profitability of their members' farms, and which involve less use of inputs. Bermejo stressed that the new crops require innovation and investment which, at present, a producer can only carry out if he is backed by a cooperative.

During this online seminar, there were mentioned the most relevant determinants of Spanish agricultural production. Such as:

- Inherent volatility of agricultural activity related to seasonal phenomena, which is explainable and moderately predictable.

- Environmental conditions of access to natural resources mark the evolution of agricultural production. Specifically, areas affected by climatic changes or water shortages have lower yields.
- Consumption habits of food or other agricultural products destined for the textile or energy industry.

These conditioning factors drive the need to work towards the diversification of farms from a social, economic, and environmental point of view. Thus, emerging crops are recovering productions from the past with retro-innovation. There are numerous examples of this type of crop, e.g., protein crops, peas, dried beans, camelina, safflower, which are a source of vegetable protein for livestock, can alleviate environmental problems and are relevant in crop rotation.

Additionally, it was highlighted the zoning of agricultural land in Spain. There are eighteen biophysical factors that have been grouped into six factor clusters, based on the EC Joint Research Centre's (JRC) work on identifying Areas with Natural Constraints:

- **Adverse climate.** Includes the ratio of annual precipitation to annual potential evapotranspiration, the sum of thermal time for the growing season defined by the cumulative average daily temperature.
- **Excessive humidity.** Includes excessive soil moisture and poor drainage.
- **Low soil fertility.** Determined by acidity, alkalinity, and organic content of the soil.
- **Adverse chemical conditions.** Influenced by salinity, sodicity, natural or anthropogenic toxicity.
- **Poor rooting conditions.** This is the most relevant group because it is based on several factors such as organic soils, adverse textures, heavy clays, abrupt texture difference, soil with closed layers (<30cm), soils with dense fragments, stones, and surface rocks.
- **Adverse terrain conditions.** Determined by areas with steep slopes and flood risk.

All these factors have been used to assess the European area and determine the marginal areas. As already mentioned, in Spain, 60% of the agricultural area is marginal (see *Figure 15*).

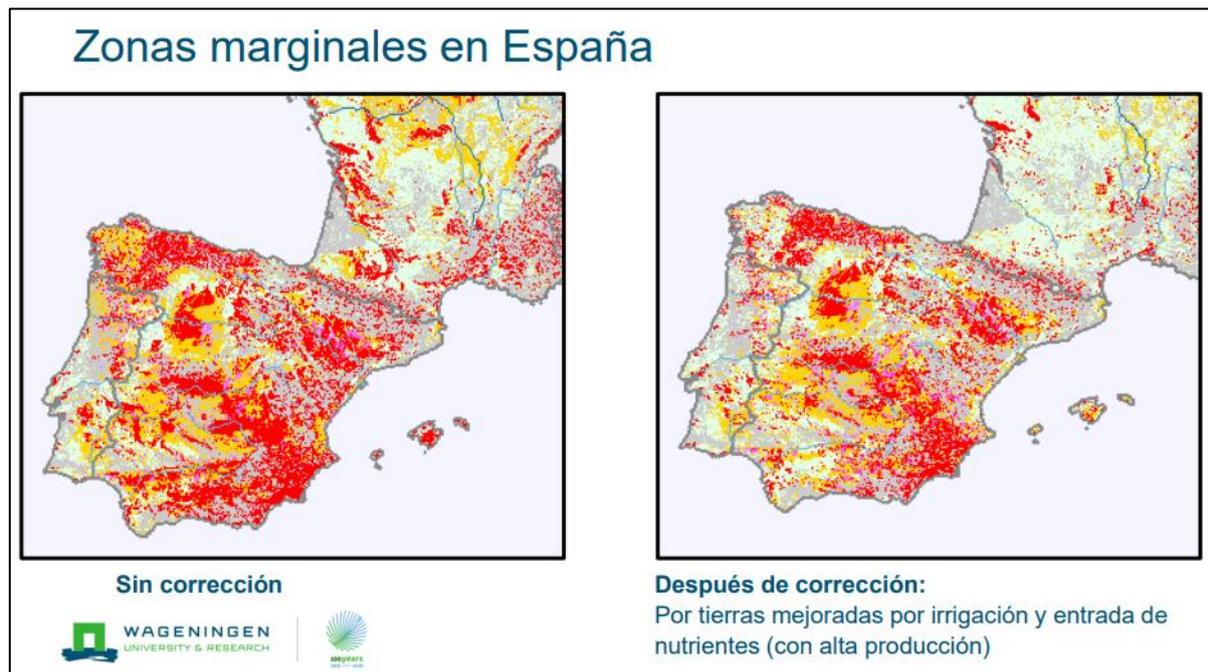


Figure 15: Map representing marginal lands in Spain. Source: WU, 2020.

The crop alternatives for marginal land must be existing resource-efficient industrial crops that:

- Are promising for production on land with natural constraints
- Develop sustainable options
- Optimise the yield of the entire biomass supply chain
- They do not interfere with food crops
- A solution for marginal rainfed land
- Helpful to make farms profitable
- Recovers and improve marginal soils
- Prevent erosion
- Increase biodiversity
- Enhance rural development
- Boost sustainable agriculture

During this webinar there were presented three tools from MAGIC project (see *Figure 16*). The first one, MAGIC MAPS allows to consult at local administration level (LAU1) the overall percentage of agricultural lands facing marginal conditions over the selected area and the extension of area affected by certain constraints. On the other hand, MAGIC-CROPS is an Excel database that offers detailed description of thirty-seven industrial crops. Finally, MAGIC DSS shows practical information regarding these marginal areas and the crops than can be cultivated in them.



**Desarrollamos una base de datos espacial**

**MAGIC databases (beta release):**

- MAGIC-MAPS**  
The MAGIC-MAPS application contains the underlying maps of marginal land and potential industrial crops for Europe.  
Visit MAGIC MAPS
- MAGIC-CROPS**  
The MAGIC-CROPS database provides a description of 37 industrial crops suitable for growing on marginal land in Europe.  
Visit MAGIC CROPS
- MAGIC-DSS**  
The MAGIC decision Support System (DSS) provides users with guidelines for industrial crops growing under marginal conditions in Europe.  
Visit MAGIC DSS

<http://magic-h2020.eu/>

WAGENINGEN UNIVERSITY & RESEARCH | MAGIC

Figure 16: MAGIC tools presented during the webinar. Source: WU, 2020.

The recording of the event is available in [YouTube](#), and were also published at MAGIC project and Spanish Co-ops websites.

### **Demonstration of industrial crops and harvesting of perennials**

The second session of the Spanish national workshop took part the 26<sup>th</sup> of October 2021, at 9:30 h. This event was meant to comply with the demo day (as an extension of the previous webinar), and due to the COVID-19 pandemic, the field visits were displayed in a virtual format. This event was organised by CIEMAT in close collaboration with IMIDRA and Spanish Co-ops (see *Figure 17*). It required an extra effort for MAGIC partners as the visits had to be recorded and edited in order to be projected to the audience. It took almost a year to make all the arrangements, obtain the final version, include subtitles, and organise the webinar.

The aim was to demonstrate the mechanization of the energy crops, showing to farmers that the cultivation of these crops can be sustainable and profitable, as well as to illustrate innovative harvesting operations, such as harvest and biomass pre-treatments. During the conference, three videos were shown regarding the lines of collaboration between IMIDRA (Madrid Institute for Rural, Agricultural and Food Research and Development) and CIEMAT, the characteristics of the crops tested at the El Encín Farm in Alcalá de Henares, the resulting biomass and a demonstration of the process and machinery necessary for harvesting

Within the bioeconomy framework, work has been developed on the identification of biomass resources, evaluation and improvements in agricultural and forestry production, primary processes for obtaining bioproducts, feasibility studies of value chains and the introduction of modern technologies.



**SEMINARIO WEB** 26 OCTUBRE  
09:30 H

**JORNADA DE DEMOSTRACIÓN DE CULTIVOS INDUSTRIALES RECOLECCIÓN DE ESPECIES PERENNES**

ORGANIZADA POR EL CEDER-CIEMAT EN EL AMBITO DE LOS PROYECTO MAGIC Y BECOOL

Magic BECOOL

**JORNADA ON LINE DE DEMOSTRACIÓN DE CULTIVOS INDUSTRIALES Y RECOLECCIÓN DE ESPECIES PERENNES**

26 de octubre de 2021 a las 09:30 h.

**INFORMACIÓN E INSCRIPCIONES** en <https://cutt.ly/VENIdKQ>

**Programa**

**09:30-09:40** Inicio de la jornada. Modera Pilar Ciria Ciria

**09:40-09:50** Inauguración de la jornada. Raquel Ramos Casado, Directora del CEDER-CIEMAT.

**09:50-09:55** Bienvenida a campos de cultivo de IMIDRA. Sergio López Vaquero, Director-Gerente de IMIDRA.

**09:55- 10:10** Demostración de cultivos industriales. Pedro V. Mauri Ablanque, Director del departamento de Investigación Agroambiental de IMIDRA.

**10:10-10:30** Demostración de la recolección mecanizada de los cultivos de olmo y caña común con la cortadora-empacadora BIOBALER WB-55. Luis S. Esteban Pascual. Jefe de la Unidad de Biomasa del Departamento de Energía del CIEMAT.

**10:30.11:00** Preguntas por parte de los asistentes.

**11:00** Clausura.

 The BECOOL project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement N° 744821.

 The MAGIC project has received funding from the European Union's Horizon 2020 Research and Innovation Programme under grant agreement N° 727698.

Figure 17: Programme of the virtual demo day in Spain. Source: CIEMAT, 2021.

Therefore, after the presentation of IMIDRA's experimental fields by its Managing Director (see *Figure 18*), the Agroenvironmental Research Director (see *Figure 19*) exposed cultivation and mechanization aspects of some of the crops cultivated such as Poplar, *Platanus hybrid*, Elm or *Arundo donax*.



Figure 18: Intervention of IMIDRA's Managing Director. Source: CIEMAT, 2021.

One of the objectives explained was the optimization of woody crops and agriculture in the Community of Madrid. This was possible thanks to the BioBaler cutter-bagger machine, which aimed to make the cultivation process sustainable and economically profitable for farmers.



Figure 19: IMIDRA's Agroenvironmental Research Director. Source: CIEMAT, 2021.

The last exhibition was performed by the Head of the Biomass Unit of CEDER-CIEMAT, who presented a prototype of machinery designed to harvest and bale the biomass in a single stage: the BioBaler WB 55. All the specifications and a life performance of this implement were exposed during this last video (see *Figure 20*).



Figure 20. BioBaler WB 55. Source: CIEMAT, 2021.

Thirty-five participants were present at the event, actively participating at the debate session arranged at the end, asking about technical specifications of the machinery and performance parameters. The videos are available in [YouTube](#), and were also published at MAGIC project, CEDER-CIEMAT and Spanish Co-ops websites.

### 3.8 Ukraine

IBCSB NAASU organized a two-day workshop “Growing Bioenergy Groups on Low-Productive Lands” that took place the 8<sup>th</sup> – 9<sup>th</sup> December 2021 at IBCSB (Institute of Bioenergy Crops and Sugar Beet NAAS Ukraine) in Kiev, Ukraine.

The workshop was coordinated in a hybrid mode on the bioenergy webex.com platform. The average number of participants amounted to two hundred and included experts on bioenergy and biomass, agronomists, researchers, farmers, and local government bodies of rural communities.

The speakers involved and their presentations are listed below:

- Prof. Dr. sc. agr. Mykola Roik, director of IBCSB, “Prospects of bioenergy crops use”
- Dr. sc. agr. Oleh Prysiashniuk, head of the Department of Mathematical Modelling and Digital Technologies in Agriculture IBCSB, “MAGIC experience on growing industrial crops on marginal lands”
- Cand. sc. agr. Oleksandr Hanzhenko, head of the Department of Sustainable Technologies of Growing and Processing of Bioenergy Crops IBCSB, “Bioenergy crops for growing in Ukraine – SEEMLA HORIZON 2020 experience”

- Dr. sc. agr. Mykhaylo Humentyk, head of the Laboratory of Breeding, Growing and Processing Energy Tree Species IBCSB, “Obtaining energy from biomass”
- Cand. sc. agr. Hryhorii Honcharuk, Yaltushkiv Experimental Breeding Station, ‘Growing energy crops on acid and low-productive soils”
- Cand. sc. agr. Volodymyr Pedos, Bila Tserkva Experimental Breeding Station, “Growing miscanthus on chemically contaminated soils”
- Cand. sc. agr. Liliia Suslyk, Uladivka-Liulyntsi Experimental Breeding Station, “Growing switchgrass on acid soils”

The results extracted from the workshop were that MAGIC trials on growing miscanthus, switchgrass and energy willow on marginal lands and related opportunities of biomass use for heating (burning), caused great interest among representatives of rural community governments. Additionally, in the context of growing prices for natural gas in Ukraine, the opportunity of growing biomass for biofuel is becoming extremely attractive.

Also, there were two experimental stations (Yaltushkiv and Bila Tserkva) that shared their experience in heat supply self-sufficiency. The biomass burners heat their buildings and greenhouses.

Another significant aspect of growing such energy crops as miscanthus and switchgrass is their positive role in soil fertility restoration and carbon capture and storage. This issue also caused interest among farmers as in the last decades Ukraine faces rapid deterioration of its famous chernozem soils.

### **3.9 Greece**

CRES, AUA & BIOS collaborated in the organization of 6 value chains events that took place on 14<sup>th</sup> of March 2018, 2 of May 2018, 10<sup>th</sup> of December 2018, 1<sup>st</sup> of March 2019, 30<sup>th</sup> of October 2019 and 31<sup>st</sup> of January 2020. The theme of the value chains was “Industrial crops for the production of bio-materials and bio-energy in Greece; Opportunities for the farmers’ community” and every time was adjusted to the specific conditions of the place that the events were organized.

In all value-chains the presentations and discussions focus on: a) what could be grown on marginal lands and/or abandoned agricultural lands and b) which annual non-food crops could be grown in rotation with food/feed crops. It should be pointed out that in Greece the area of cultivation of three traditional industrial crops had been gradually reduced namely for cotton, tobacco and sugar beets. Thus, for the released agricultural areas the farmers are looking for new crops to grow. During the six events the majority of the participants were asking for industrial hemp as source for fibres and seeds. When camelina and castor presented, the farmers asked a lot of questions mainly on camelina due to the short growing cycle and the multiple uses and secondly on castor since this crop can be found everywhere in Greece as native species. Moreover, in the majority of the events some success examples on non-food crops were presented and thoroughly on industrial hemp, lupin and lavender.

The selected top-five NFC value chains for Greece are:

- ➔ **Hemp** for insulation mats, construction materials, CBD production, textiles and pellets from its core
- ➔ **Camelina** for lubricants, surfactants, polymers, biofuels cosmetics and health care products
- ➔ **Switchgrass** for bioenergy and biobased materials
- ➔ **Castor** for lubricants, surfactants, polymers, biofuels and pharmaceuticals
- ➔ **Lupin** for lubricants, surfactants, polymers, pharmaceuticals and cosmetics



Figure 21. National workshop in Orestiada/Greece (14/3/18)



Figure 22. National workshop in Drama/Greece (10/12/18)



Figure 23. National workshop in Larisa / Greece (1/3/19)

Switchgrass and hemp exhibit high yields and have been grown at large scale using existing machinery while camelina, castor and lupin are crops with good yielding capacity that have not yet been grown at large scale. All selected near-to-practice crops have good interest for their multiple uses. Switchgrass can be used for bioenergy, biofuels and building materials and was mainly selected as perennial grass that can be grown successfully on marginal lands with annual mean yields higher than 10 t/ha. Hemp has strong potential as feedstock for insulation mats and bio composites and as feedstock for oil and CBD. The cultivation area of industrial hemp in Greece is around 300 ha and so far it is grown for its flowers and seeds but there is a growing interest to be grown for its stems. Lupin is an old-new crop for Greece. It used to be grown as feed crop in southern Europe on dry areas and recently it is being exploited as source for oil and protein for industrial applications. Lupin can be used for bioactive compounds. Camelina has a quite short growing cycle and can be grown both as winter and spring crop and its harvesting time is earlier than wheat (it can be harvested in the 2<sup>nd</sup> half of May or in the 1<sup>st</sup> half at the latest) and in case of water availability a second crop

can be grown (sunflower, sorghum, etc.) and thus in a year a double cropping could be feasible for the farmers. Castor has more or less the same growing cycle with cotton and it has been proved as high yielding crop in the experimental field carried out so far in Greece (>3 tn seeds/ha with >50% oil content) and with numerous possible end uses.

## 4. Conclusion

The workshops presented in this document aimed at the dissemination of the outcomes and tools created in the MAGIC project towards the end users, as well as the demonstration of the machinery performance. MAGIC partners have intensively collaborated with other institutions in order to enlarge the project network and to transfer critical information that can also be shared by external advisory and training centres, spreading the word.

Thus, partners from nine European countries, including France, Germany, Greece, Italy, Latvia, Poland, Portugal, Spain and Greece, and also from Ukraine, have managed to arrange over the four years life of the project (and despite of the COVID-19 pandemic) more than fifth teen national workshops and several demo days with a total estimated attendance of above 900 stakeholders.

These events were a unique occasion to support MAGIC partners to fine-tune the tools and to get different views, experiences and approaches that have enriched the consortium and its final outcomes.

The COVID-19 pandemic has forced MAGIC partners to re-plan the initial approach and, as a consequence, huge efforts were made to be flexible and adapt to conditions through the arrangement of online or hybrid events, virtual field visits or physical ones when it was possible.

## 5. References

Demonstration day of industrial crops and perennial species collection, 2021.

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4CE-MED – Camelina: A cash cover crop enhancing water and soil conservation in Mediterranean dry-farming systems

<https://www.4cemed.eu/>