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MED-GOLD

Turning climate-related information into added value for traditional **MED**iterranean**G**rape, **OL**ive and **D**urum wheat food systems

Deliverable 2.7

Second Feedback report from users on olive oil pilot service development

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Document Status Sheet

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Brief Description		
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Contributors	*NOA (Giannakopoulos C., Gratsea M.), DCOOP (López-Feria S; López-Nevado J), ec2ce (Arjona R), University of Leeds (Bruno Soares, M), ENEA (Ponti L)*	
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Revision History Log

Version	Date	Created / Modified by	Pages	Comments
1.0	21/04/2020	DCOOP	18	Initial draft
1.1	14/05/2020	DCOOP / NOA / ENEA	34	Draft for review from the co-authors
1.2	21/05/2020	DCOOP / NOA / ENEA / GMV / MetOffice	57	Final draft for internal review
1.3	29/5/2020		59	Final document

All partners involved in the production/implementation of the deliverable should comment and report (if needed) in the above table. The above table should support the decisions made for the specific deliverable in order to include the agreement of all involved parties for the final version of the document.

Finally, after the peer review process, the deliverable should be modified accordingly to the comments and the reflections to the comments should be reported in the above table.

Disclaimer

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Executive Summary

This report - "Second feedback report from users on olive oil pilot service development" – presents the results of the second feedback workshop, carried out as a liaison between the tool developers of the MED-GOLD project and the end-users. All the interactions of the workshop were held online due to the restrictions imposed in order to prevent the spread of the COVID-19 disease. The purpose of the workshop was the evaluation of the two applications -Olivia platform and Dashboard- developed in the framework of the MED-GOLD project. Apart from the outcome of the online survey for the Olivia platform, and from the virtual meeting for the evaluation of the Dashboard, the continuous feedback from DCOOP from the previous focus group until now is also presented in this report, as this procedure has contributed to the design of both applications. The third application developed for the olive/olive oil sector -CASAS-PBDM- was not included in the evaluation procedure due to the negative feedback from the users in the previous workshop; reorganization and shift of focus towards policymakers was required.

Overall, the users found useful the Olivia platform and reported that it helped them in making the necessary treatment plans for the olive fly pest. They made some comments and suggestions for the improvement of the application. Accordingly, the Dashboard was also described as useful by the users. However a lot of improvement is required in terms of data acquisition and visualization. It should be noted that the evaluation of the Dashboard was made using indices different from the ones selected as appropriate for the olive sector, thus the main concern of the end-users was whether the indices for the olives would be available in the final version of the tool. Also, the seasonal forecasts were deemed to be much more useful for key decision making than the long-term projections.

With this deliverable, the project has contributed to the achievement of the following objectives (DOA, PartB Table1.1):

No.	Objective	Yes
1	To co-design, co-develop, test, and assess the added value of proof-of-concept climate services for olive, grape, and durum wheat	X
2	To refine, validate, and upscale the three pilot services with the wider European and global user communities for olive, grape, and durum wheat	
3	To ensure replicability of MED-GOLD climate services in other crops/climates (e.g., coffee) and to establish links to policy making globally	
4	To implement a comprehensive communication and commercialization plan for MED-GOLD climate services to enhance market uptake	
5	To build better informed and connected end-user communities for the global olive oil, wine, and pasta food systems and related policy making	X

1. INTRODUCTION

The olive tree is the characteristic and one of the most important crops in the Mediterranean region. MED-GOLD's objective for the olive/olive oil sector is to create innovative climate services in order to help agricultural management to adapt to climate change; climate information for the next days, season or longer time scales will be available.

Key decisions for the management of the olive crop were identified during a workshop that took place in April 2018 in Spain [RD.1]. A beta version of the climate service tool, based on the users' needs gathered during the first workshop, was presented and evaluated by the end-users during a second workshop in May 2019 [RD.2]. In both workshops, the end-users (mainly agronomists) were staff of DCOOP.

Briefly, during the first workshop, certain essential climate variables and bioclimatic indices were selected by the participants as the most important ones for addressing the challenges faced by the olive/olive oil sector. During the second workshop, the evaluation of the beta version of the tool revealed that the participants were mostly interested in the tool presented by EC2CE (Olivia platform), which integrates seasonal climate predictions with other data through the use of artificial intelligence. This tool contains seasonal predictions of expected productivity and provides advice for management. They also expressed their objection to the focus on past data of the beta version; although it was for validation reasons. In the final version, they will be able to explore results for the coming season. Also, as a response to the needs expressed by the users during the second workshop (focus group), a web-based application (hereafter MED-GOLD Dashboard tool) was developed for the visualisation and download of climate data and indices by the users.

In this third workshop, which was held online due to the restrictions imposed for the limitation of the spread of the COVID-19 disease, end-users were asked to evaluate and comment the available online tools (Olivia platform and the dashboard tool). Along with the feedback of this workshop, which was held in May 2020 either through online survey or through seperate online meetings, the present deliverable also reports on a number of issues that was raised during the previous focus group. These issues were addressed in August 2019, and contributed to the design of the tools.

1.1. PURPOSE

This report summarizes the results of the interaction with the end users in order to describe the feedback and suggestions for the tools developed for the olive sector. More specifically, the purpose of this deliverable is to i) summarise the outcome of the Dashboard meeting with DCOOP's members for the evaluation of the Dashboard tool, ii) present the outcome of the online survey which was conducted in order to provide feedback for the most recent version of the Olivia platform by end-users of DCOOP and EC2CE and to iii) present the continuous feedback from DCOOP since the previous workshop which contributed to the design of the MED-GOLD tools.

1.2 Scope

The scope of the workshops is to serve as a liaison of the MED-GOLD project and the tool developers with the end-users who are going to benefit from this project. The MED-GOLD aims to provide essential information to the end-users, enabling them to adapt their decision making strategies to the climate conditions and climate change. The agricultural sectors to be benefited from the project are the crops of the Mediterranean diet - durum wheat, grapes and olives.

1.3 Definitions and acronyms

1.3.1. Definitions

Concepts and terms used in this document and needing a definition are included in the following table:

Table 1-1 Definitions

Concept / Term	Definition
DCOOP	Second degree cooperative.The largest producer of olive oil and table olives in the word.
Field Notebook	Field Notebook is a register document that records information about phytosanitary treatments required in each farm/plot. It is a mandatory document according to Spanish law (Real Decreto 1311/2012). It is the translation of "Cuaderno de Campo"
OLIVIA	TIC platform based on Artificial Intelligence developed by EC2CE that provides seasonal predictions of expected productivity and advice for pest management.
Agronomists/Technicians	The group of people who advises and/or orders the farmers about the nutrition, the health of the olive trees and the actions that could be taken in order to avoid pest problems in the olive farms.
MED-GOLD Dashboard	Web-based application that developed to apply climatic services to the agricultural sectors of MED-GOLD project.

1.3.2. Acronyms

Acronyms used in this document and needing a definition are included in the following table:

Table 1-2 Acronyms

Acronym	Definition
MED-GOLD	Mediterranean Grape, OLive and Durum wheat food systems
FG	Focus Group
ET0	Evapotranspiration
IPM	Integrated Pest Management
AI	Artificial Intelligence
CASAS	Center for the Analysis of Sustainable Agricultural Systems
PBDM	Physiologically Based Demographic Models
SIGPAC	Acronym Spanish, Agriculture Parcels Geographic Information System
Ha	Hectares

2. References

2.1 Reference Documents

The following documents, although not part of this document, amplify or clarify its contents. Reference documents are those not applicable and referenced within this document. They are referenced in this document in the form [RD.x]:

Table 2-1 Reference Documents

Ref.	Title	Code	Version	Date
[RD.1]	Report on the knowledge capitalization of the olive oil sector	Deliverable 2.1 / D.2.1		2018
[RD.2]	First feedback report from users on olive oil pilot service development	Deliverable 2.6 / D2.6		2019

[RD.3]	Consejería de Agricultura, Pescas y Desarrollo Rural, Junta de Andalucía. (2017) Aforo de producción de olivar en Andalucía campaña 2017-2018. 33 pp	Consejería de Agricultura, Pescas y Desarrollo Rural, 2017		2017
[RD.4]	Gutierrez, A.P., 1996. Applied population ecology: a supply-demand approach. John Wiley and Sons, New York, USA.	Gutierrez, 1996		1996
[RD.5]	Gutierrez, A.P., Ponti, L., Cossu, Q.A., 2009. Effects of climate warming on olive and olive fly (*Bactroceraoleae* (Gmelin)) in California and Italy. Climatic Change 95, 195–217. https://doi.org/10.1007/s10584-008-9528-4	Gutierrez et al., 2009		2009
[RD.6]	Ponti, L., Cossu, Q.A., Gutierrez, A.P., 2009. Climate warming effects on the *Olea europaea–Bactroceraoleae* system in Mediterranean islands: Sardinia as an example. Global Change Biology 15, 2874–2884. https://doi.org/10.1111/j.1365-2486.2009.01938.x	Ponti et al., 2009		2009
[RD.7]	Ponti, L., Gutierrez, A.P., Ruti, P.M., Dell'Aquila, A., 2014. Fine-scale ecological and economic assessment of climate change on olive in the Mediterranean Basin reveals winners and losers. Proceedings of the National Academy of Sciences, USA 111, 5598–5603. https://doi.org/10.1073/pnas.1314437111	Ponti et al., 2014		2014
[RD.8]	Toko, M., Neuenschwander, P., Yaninek, J.S., Ortega-Beltran, A., Fanou, A., Zinsou, V., Wydra, K.D., Hanna, R., Fotso, A., Douro-Kpindou, O., 2019. Identifying and managing plant health risks for key African crops: cassava, in: Neuenschwander, P., Tamò, M. (Eds.), Critical Issues in Plant Health: 50 Years of Research in African Agriculture, BurleighDodds Series in Agricultural Science. BurleighDodds Science Publishing, Cambridge, UK, p. doi:10.19103/AS.2018.0043.07. https://doi.org/10.19103/AS.2018.0043.07	Toko et al., 2019		2019
[RD.9]	Neteler, M., Bowman, M.H., Landa, M., Metz, M., 2012. GRASS GIS: a multi-purpose Open Source GIS. Environmental Modelling & Software 31, 124–130. https://doi.org/10.1016/j.envsoft.2011.11.014	Neteler et al., 2011		2011
[RD.10]	Monfreda, C., Ramankutty, N., Foley, J.A., 2008. Farming the planet: 2. Geographic distribution of crop areas, yields, physiological types, and net primary production in the year 2000. Global	Monfreda et al., 2008		2008

	Biogeochemical Cycles 22, GB1022.https://doi.org/10.1029/2007GB002947			
[RD.11]	Ruane, A.C., Goldberg, R., Chryssanthacopoulos, J., 2015. Climate forcing datasets for agricultural modeling: Merged products for gap-filling and historical climate series estimation. Agricultural and Forest Meteorology 200, 233–248.https://doi.org/10.1016/j.agrformet.2014.09.016	Ruane et al., 2015		2015
[RD.12]	D1.3 Assessment of quality of European climate observations and their appropriateness for use in climate services for each sector	Deliverable 1.3 / D1.3		2018
[RD.13]	D1.4 - Report assessing the quality of seasonal forecast information and climate projections, and their appropriateness for use in climate services for each sector	Deliverable 1.4 / D1.4		2018
[RD.14]	IPCC, Intergovernmental Panel on Climate Change, 2007. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.	IPCC, 2007		2007
[RD.15]	IPCC, Intergovernmental Panel on Climate Change, 2014b. Climate change 2014: Impacts, Adaptation, and Vulnerability. Part A: global and sectoral aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.	IPCC, 2014		2014
[RD.16]	Copernicus Climate Change Service, (C3S), 2019. Agrometeorological Indicators from 1979 to 2018 Derived from Reanalysis. Copernicus Climate Change Service Climate Data Store (CDS).https://doi.org/10.24381/CDS.6C68C9BB	C3S, 2019		2019
[RD.17]	Copernicus Climate Change Service, (C3S), 2017. ERA5: Fifth Generation of ECMWF Atmospheric Reanalyses of the Global Climate. Copernicus Climate Change Service Climate Data Store (CDS).https://cds.climate.copernicus.eu/cdsapp#!/home	C3S, 2017		2017
[RD.18]	D2.2 Report on the tool performance	Deliverable 2.2 / D2.2		2020

[RD.19]	Junta de Andalucía - Consejería de Agricultura, Ganadería, Pesca y Desarrollo Sostenible, 2020. Sistema de Información Geográfica de Identificación de Parcelas Agrícolas (SIGPAC). SIGPAC web.http://www.juntadeandalucia.es/agriculturaypesca/sigpac	SIGPAC, 2020		2020
[RD.20]	MED-GOLD Deliverable 3.7: Second Feedback report from users on wine pilot service development	Deliverable 3.7 / D.3.7		2020
[RD.21]	MED-GOLD Deliverable 4.7: Second Feedback report from users on durum wheat pilot service development	Deliverable 4.7 / D4.7		2020

3. Olive oil pilot services developed

Following the previous workshops - involving interaction with users from the olive/olive oil sector - (First scoping workshop in Antequera in June 2018, User perceptions workshop in Brussel in February 2019 and the Focus Group in Antequera in May 2019) [RD.1], [RD.2], [RD.18], WP2 team organised online interactions with the users in May 2020 in order to obtain a second feedback on the pilot services developed by the MED-GOLD team. The interaction was carried out remotely, through an online survey, due to safety reasons during the COVID-19 crisis.

Feedback, questions and suggestions shown in this deliverable, were collected by 3 types of interaction with users from the olive sector:

1. Questions and answers that arose after the last year's Focus Group meeting of the olive sector.

2. Online survey addressing the users of the Olivia platform in 2019: 26 participants from DCOOP and EC2CE's end-users.

3. Online demonstration of the MED-GOLD Dashboard. The participants of this interaction are shown in table 3.1.

Table 3-1 Participants of the online demonstration of MED-GOLD Dashboard (olive tool)

Name	Organisation	Role	Attended Focus Group 2019	Attended workshop June 2018
Participant 1	DCOOP	Department of supplies and services	Yes	Yes
Participant 2	DCOOP	Department of olive oil logistics	Yes	No
Participant 3	DCOOP	Department of quality of olive mills	No	No
Participant 4	DCOOP	Department of R&D&I	No	Yes
Participant 5	DCOOP	Department of R&D&I	Yes	No

Participant 6	DCOOP	Department of R&D&I	Yes	Yes

4. Interaction following the feedback from Focus Group 2019

After the analysis of the results from the Focus Group regarding the tools demonstrated in the event, the MED-GOLD team drew several conclusions that are included in Deliverable 2.6 [RD2]. An important outcome of this Focus Group was a list of comments and questions (Annex E of Deliverable 2.6) that requested further feedback from DCOOP. These questions were worked out and answered by DCOOP during the summer of 2019. This allowed continuous feedback from DCOOP, which helped in the design of the olive pilot services in the most suitable way for the olive sector.

A summary of this interaction is presented in this section in the form of a list of questions and answers.

4.1. Feedback after Focus Group 2019

Issue 1

Farmers do not usually record data digitally related to olive production.

Question: Is there any statistical data collected by third parties (e.g. local government) available?

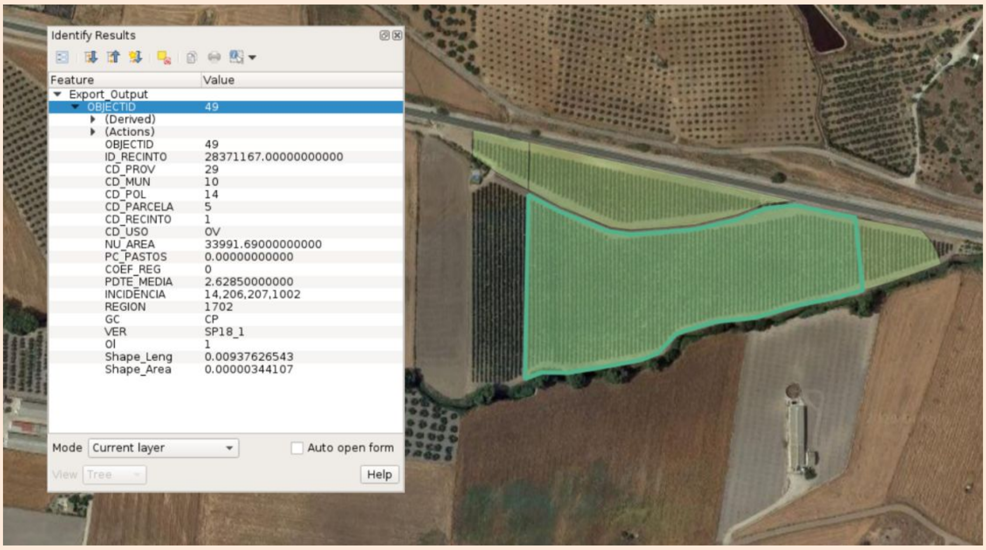
Answer:

Information about olive farms can be obtained from the website of the Government of Andalusia. Information such as farm size, irrigated or non-irrigated, and average slope can be collected with unit values from all the farms in Andalucia through the SIGPAC tool.

The information on farm size, irrigated or rainfed and average slope can be collected from the SIGPAC REPORT from “Junta de Andalucía” (Government of Andalusia). This information is presented as unit values from each plot. Before getting the document, the user must select in the web service SIGPAC: (http://www.juntadeandalucia.es/agriculturaypesca/sigpac/index.xhtml) the plot that he wants to consult.

Geographic information could be downloaded from:
https://www.juntadeandalucia.es/organismos/agriculturaganaderiapescaydesarrollosostenible/areas/politica-agraria-comun/paginas/sigpac-descarga-informacion-geografica-shapes-provincias.html.

Figure 4-1: SIGPAC available public information.



<u>Issue 2</u>

FG participants mentioned the '% insolation' as an important parameter for the flowering.

Question: Which is the definition of '% insolation'?

Answer:

The insolation is defined as the total energy from sun (direct and indirect radiation) that a terrestrial surface receives during a period of time (Wh/m^2).

The equation of this term is:

$$H = \int_{t1}^{t2} I dt$$

Where:

H: Irradiation (Wh/m2)

I: Irradiance (W/m2)

t: time

An operational seasonal definition regarding this term from the point of view of DCOOP´s participants could be: the total energy from sun (direct and indirect radiation) that a terrestrial surface receives on a monthly basis, from May to August (4 months).

The insolation might be a variable to take into account in the olive crops since it may affect the flowering capacity of the trees. High insolation during flowering can "burn" the flowers, reducing their number and consequently the number of produced olives.

Knowing the level of insolation in advance could assist the farmers with the decision of spring pruning (February-April). For example, if a farmer knows in February that the insolation during flowering and summer will be very high, they could decide to reduce pruning in order to maintain sufficient leaf area which would reduce the possibility of damage to the trees, flowers, and olives from irradiation.

Although it is not clear, the irradiation in climate projections (over the next 10-50 years) could be a parameter in the olive case. Climate change and associated changes in greenhouse gases concentration affect the amount of energy that falls upon the ground. This change directly affects evapotranspiration (ET0), an important parameter for the hydration of the olive grove. Perhaps these projections could show regions where high radiation can cause great water stress to the olive grove or prevent proper flowering. The MED-GOLD team suggests the use of the heat stress parameter instead of insolation, since the calculation of the latter involves knowledge of the atmospheric dynamics. This remains to be discussed in future interactions with the end-users.

Issue 3

Precipitation from October to May (8 months), on a monthly basis for the next 6 months or for the next year was mentioned by the FC participants as interesting information.

Question: Why is this information important? Please, clarify the meaning of “for the next 6 months or for the next year”.

Answer:

For the next 6 months or next year, means the timescale in which the monthly precipitation is necessary. In other words, we are looking for a seasonal forecast of 6-12 months in advance.

Rainfall from October to May has a high impact on the production of olives. For two main reasons:

1. On the one hand, in the months of October/November, when the olives enter the veraison phase (envero in Spanish) and the formation of oil takes place, it is necessary that the soil is humid enough to avoid hydric stress of the trees; that is to say, in autumn the olives need water to mature and produce oil.

   On the other hand, in autumn/winter (when the olives are harvested), rain makes harvesting impossible. When the olives are not harvested for days or weeks, the quality of the olives decreases since the stage of maturity progresses. In this case, the composition of the olive changes and causes decreased quality. Also, if the skin of the olives is wet due to the rain during harvesting, the fermentation processes are favored during the transport and in the reception in the oil mills and this can also lead to decreased quality and the oil can not be characterised as extra virgin.

Besides, with high humidity in the soil, the machinery faces more difficulties to collect olives.

2. Once the olives have been harvested, from February to May, the water received by the tree is used for the correct growth of the tree. The olive tree, in these months, needs water to complete its biological cycle and phenological stage. The rain is critical for a correct flowering that will allow the development of the future fruit of the next campaign. In other words, winter/spring precipitation is a relevant variable (although not the only one) in order to estimate the amount of the olives for the next season (yield), which is a critical issue.

In the Andalusian olive sector, we may consider a 1-year season from 1 September to 31 August of the following year.

September is usually the month in which the first olives are harvested and transformed into table olives. Although this is not always true; indeed, sometimes the olive cannot be harvested until October since the ripening depends on several parameters:

- Variety.
- Weather conditions.
- Location in Andalusia. In some regions maturity is slower than in others.

Issue 4

During the Focus Group, the participants commented they are more interested in quantitative data than maps or graphics.

Question: By whom and how is this information going to be used? The climate-related decision-making process of DCOOP should be reviewed.

Answer:

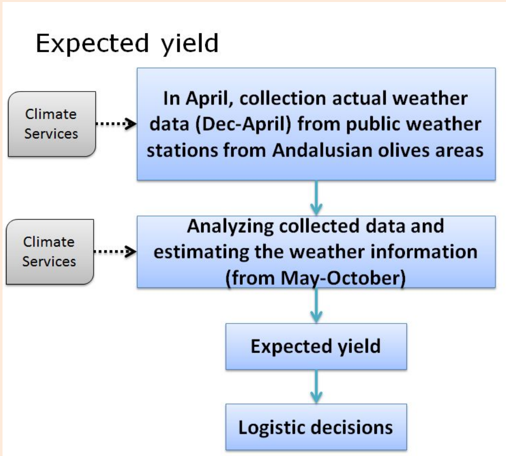
The Department of Olive Oil Logistics could use the numerical and graphical values of seasonal predictions in its calculations to estimate the volume expected of olive oil produced for the next season (if the forecast can provide numerical values).

Currently, this department tries to predict in April the number of olives that will be harvested in the following campaign for olive oil (approximately from October/November to February/March). This information can be used to make logistical decisions that affect the current and next season.

Since the olive production estimation depends on other parameters apart from climate, such as the new plantations or the modernization of the farms, DCOOP believes that seasonal forecasts will provide greater added value through estimation of the production. This DCOOP´s department hasn´t used the information on climate projections (several years in advance) but it could try to test it in the calculations.

DCOOP could use the information provided by the MED-GOLD project in order to check if the provided climate information improves the skill or accuracy of the in-house calculations. It could be worked on in future. An approximation to the diagram of the decision-making process to estimate olives productions for next season is shown in Fig. 4-2.

Figure 4-2: A visual approach to the decision-making process for the production prediction in DCOOP.



Another part of the issue 4 was to identify the decision-making of:

A. Phytosanitary treatment/pest/disease
B. Fertilization
C. Irrigation

The following paragraphs describe the decisions that could be made by the Andalusian farmers and/or technicians. It should be noted, though, that the majority of farmers are "non-professionals" and they usually own farmlands of small size. The technicians can use different strategies regarding the Integrated Pest Management. Also, DCOOP doesn't manage the olive crops since DCOOP doesn't own olive farms. The olives that become the final product commercialized by Dcoop originate from farms owned by farmers associating with DCOOP. DCOOP offers services and advice to its associated farmers but the farmers make the final decision about their olive farms. For these reasons, the following descriptions should be considered as an indicative approach to decision making for farmers and technicians.

<u>Phytosanitary treatment/pest/disease</u>

In Andalusia,two main actors can be identified:

- Technician: person who meets a series of requirements imposed by law to demonstrate sufficient training in integrated production and pests management. This technical knowledge must be certified by an official entity, such as a university.
- Farmers: a person who grows olive. This person may or may not have technical knowledge.

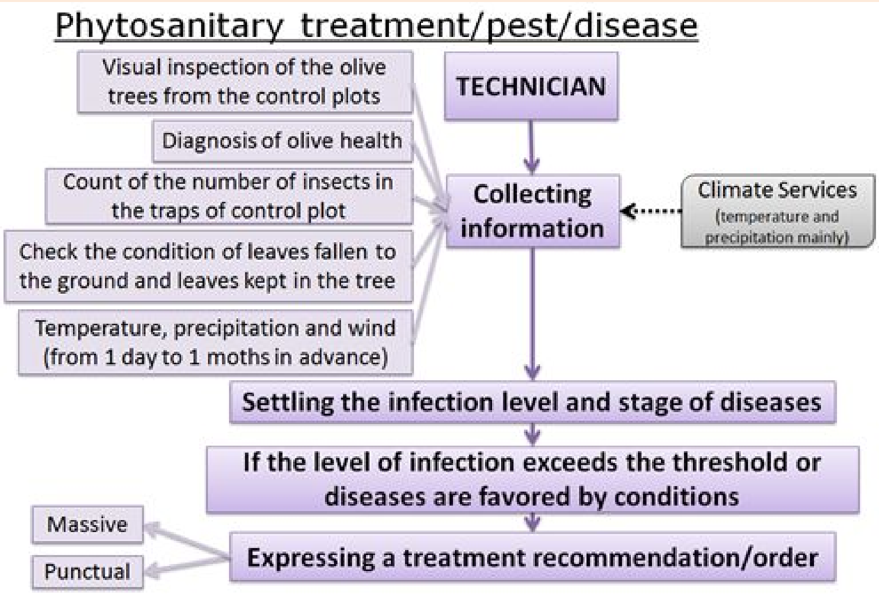
The technician's making-decision progress could be summarized into several steps:

1. The technician collects information related to diseases and pests by several methods such as:
   - Visual inspection of the control plot.
   - Selecting some olive trees as a sample and make a health diagnosis.
   - Counting the number of insects in the traps in the control plot.
   - Checking the condition of the leaves that have fallen to the ground and the leaves of the tree.
   - Checking the weather forecast, mainly temperature, humidity, precipitation and wind from 1 to 15 days in advance.

In the case of collecting information, the technician might use climatic information such as temperature and precipitation (some weeks in advance) because some diseases and pests are caused by organisms that need certain levels of humidity and temperature to grow.

2. After analyzing the information collected, the level of infection (pests) and the state of the diseases is established.
3. When the level of infection exceeds the limit or the tree and environmental conditions are favorable for the spread of diseases, the technician could issue a recommendation or order for phytosanitary treatment to reduce the damage. The recommendation or orders may be punctual or massive.

Figure 4-3. : Summary of decision-making from technicians regarding the key decision of Phytosanitary treatment/pest/disease.



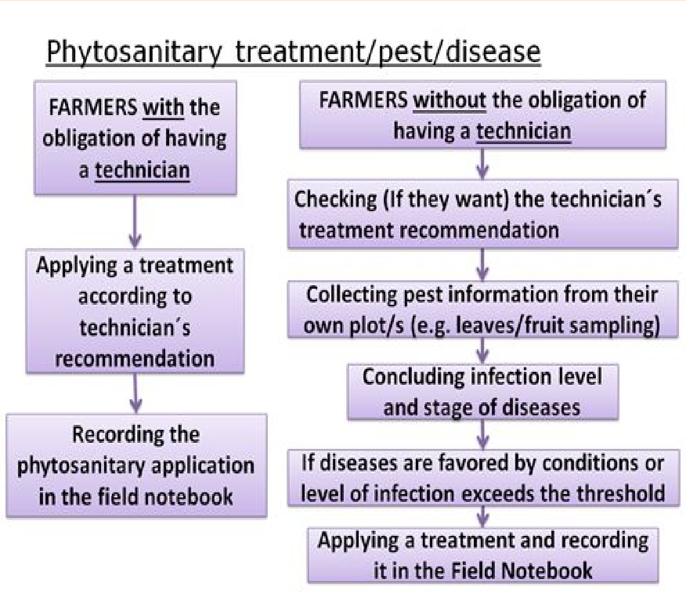
Regarding the farmers, two possible situations exist according to the size of their farmlands:

1. Usually, when a farmer has a total area of olive groves greater than 5 Ha, he must have a technician to advise him regarding pests, diseases, and phytosanitary treatments.

1.1. This type of farmer must apply the treatment according to the order issued by the technician. The treatment order describes the product authorized to fight the pest, the dose to be used, an approximate date, etc. This order is signed by the technician and must be followed by the farmer.
1.2. Once the phytosanitary treatment is made by farmers, the farmer must record it in the Field Notebook so the technician can check whether the treatment was applied according to his order.

2. Usually, when a farmer has a total olive grove area of fewer than 5 hectares, he doesn't need to have a technician to advise him on pests, diseases, and phytosanitary treatments.
   2.1. This type of farmer can check (if he wants) the treatment recommendation made by technician.
   2.2. The farmer must collect information regarding pests and diseases from his plot (e.g. by leaf and fruit sampling). At this point, the farmer may use the climatic information if he is able to understand it.
   2.3. The farmer must set, by data and information, the level of infection (pests) and the state of the diseases. When the level of infection exceeds the limit or the tree and environmental conditions are favorable for the spread of diseases. The farmer could apply the treatment that the law permits.
   2.4. Once the phytosanitary treatment is made by the farmer, he must record it in the Field Notebook

Figure 4-4: Phytosanitary treatment/pest/disease decision-making process from a farmer's perspective.

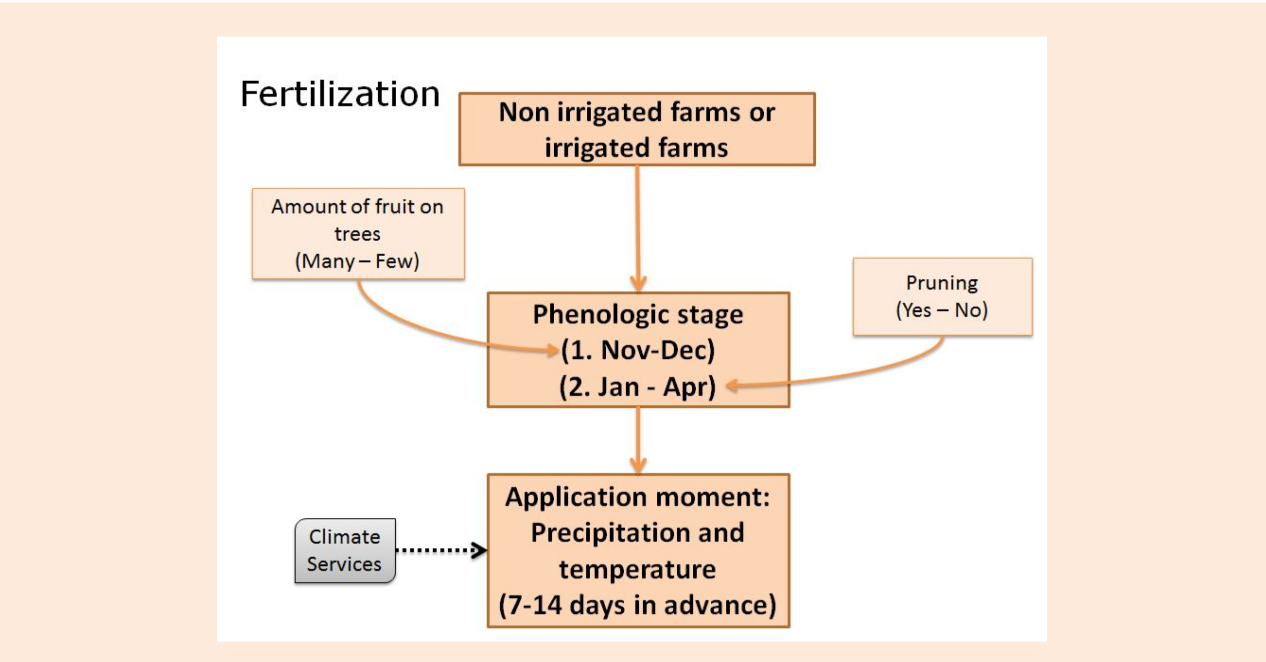


Fertilization

1. Type of Farming: Dry or Irrigated farming.

2. Phenological stage: In olive crop there are 2 moments every season when the farmers should decide whether to fertilize or not:
    2.1. November-December. Usually, fertilization depends on the fruit of the tree. If the trees have got many olives, the farmers fertilize in November-December to avoid losing the production since the trees will need nutrients to keep the olives in its branches until harvesting. However, in some cases the harvest takes place earlier, thus the fertilization happens in October-November.
    2.2. January-April. Usually, fertilization depends on pruning. If in one year, the trees have been pruned after harvesting, the farmers fertilize to ensure the nutrients for olive trees.
3. Application moment: the farmers check the weather forecast 7-14 days in advance to choose the day of fertilization:
    3.1. For non-irrigated farms, farmers need weather forecasts (precipitation and temperature) to set the day of fertilization. Usually, farmers use solid fertilizer in the soil, which needs water to allow the trees to get the nutrients from the fertilizer. Also, high temperatures degrade the fertilizer.
    3.2. For Irrigated farms, weather forecast information is less important than non-irrigated. However, farmers could check the precipitation 7-14 days in advance since the fertirrigation isn't advisable when there is high precipitation as the fertilizer could be washed off and contribute to the environmental pollution.

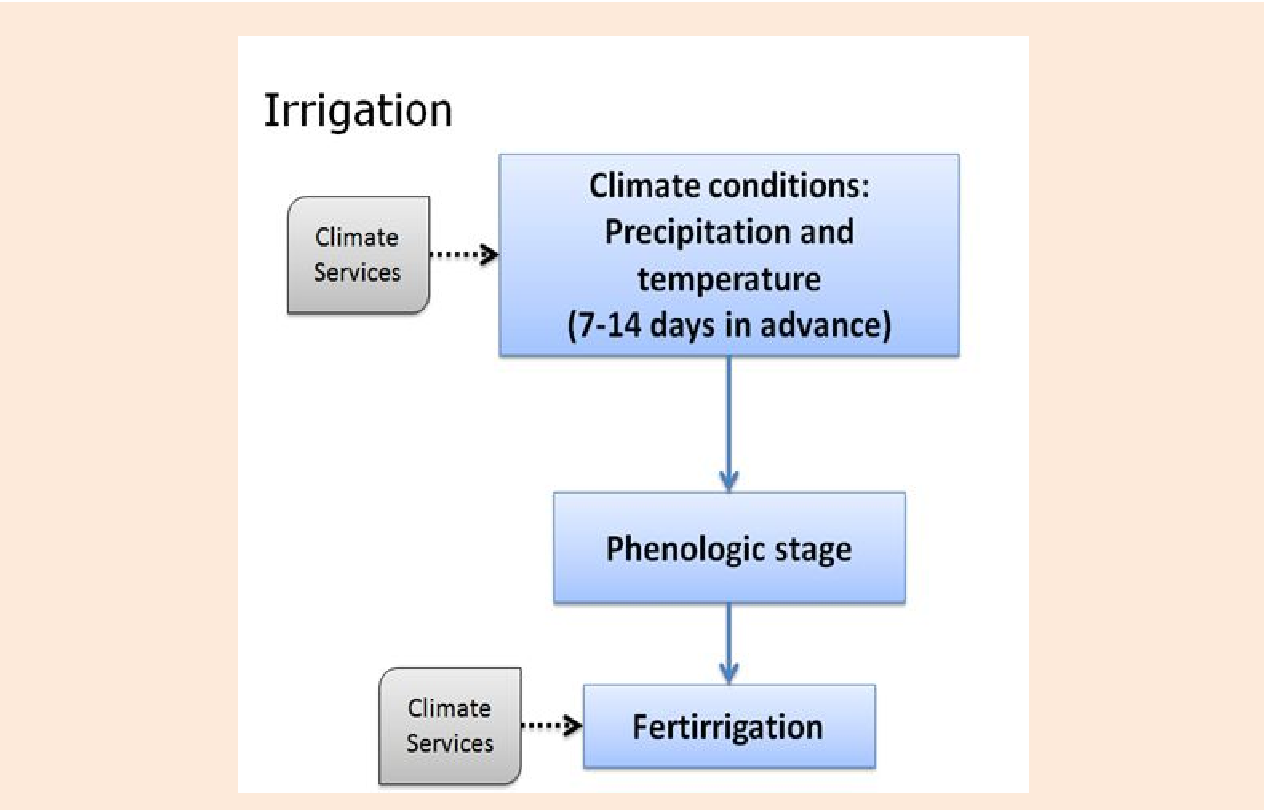
Figure 4-5. : Summary of decision-making from farmers regarding the key decision of fertilization.



Irrigation:

1. Climate conditions: The farmers use the weather forecasts in order to plan the irrigation. They check precipitation and temperature information in the short term (7-14 days in advance).
2. Phenological stage: the farmers consider that the olive trees in Andalusia have two “stops”: Winter stop (December- January) and summer stop (July - August). In these moments farmers don't irrigate the olive trees since the biological activity of the olive trees is very low and trees don't use the provided nutrients and inputs efficiently. Sometimes, farmers irrigate olive trees during the summer stop due to the extreme heat of Andalusia.
3. Fertirrigation: irrigated olive farms can use the irrigation to provide nutrients to the trees. Although the main goal is to provide nutrients by the irrigation system, the olive trees can use the water. Farmers can need to check the precipitation 7-14 days in advance since the fertirrigation isn't advisable when the precipitation amount is large since it could cause the fertilizer to disappear from the soil.

Figure 4-6: Irrigation decision-making process from a farmer’s perspective.



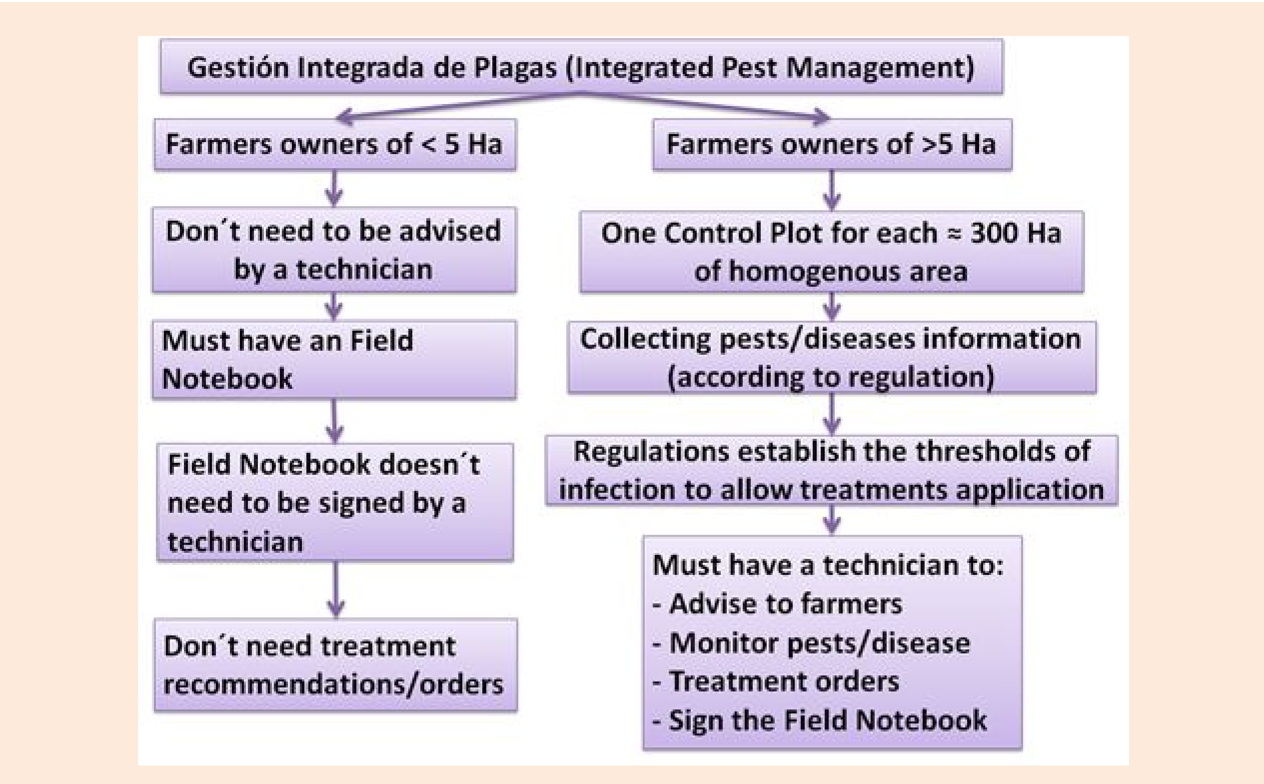
The last point of issue 4 was to describe the Integrated Pest Management (IPM) decision-making process used in Andalusia. Although there are several types of strategies for controlling pests and diseases in olive crops in Andalusia, the main strategy is Integrated Pest Management (Gestión

Integrada de Plagas in Spanish) formed by the application of Directive 2009/128/EC in Spain through the national law ("Real Decreto 1311/2012, de 14 de septiembre, por el que se establece el marco de actuación para conseguir un uso sostenible de los productos fitosanitarios").

When farmers employ a technician, he establishes a control plot for every 300 ha of the homogeneous cropping area to collect data and information about pests and diseases (according to the regulations). Technicians advise farmers, monitor pests and diseases, order and check treatments and sign the Field Notebook. If a farmer does not employ a technician, technician's signature in the Field Notebook and the treatment recommendations aren't mandatory, he has to collect the information about the pests and diseases and set the pests thresholds and disease conditions before treatment.

Seasonal forecasts might be included when the technicians carry out the task of collecting information on pests and diseases. Such forecasts could include the temperature and precipitation for a few weeks or months in advance. However, it seems that this information would only serve for preventive treatments in some cases.

Figure 4-7: Description of Integrated Pest Management.



Issue 5

Focus Group participants stated that they are already aware of the fact that South Spain is expected to become drier and hotter in the long-term.

Question: Does this also imply that DCOOP is much more interested in the seasonal forecasts of the bioclimatic indices?

Answer:

According to Dcoop's participants, the seasonal forecasts (6-15 months ahead) of the bioclimatic indices are more useful than the climate projections. Climate projections do not seem to play an important role in current agriculture practices. However, other olive organizations or parts of the sector could be interested in climate projections.

Issue 6

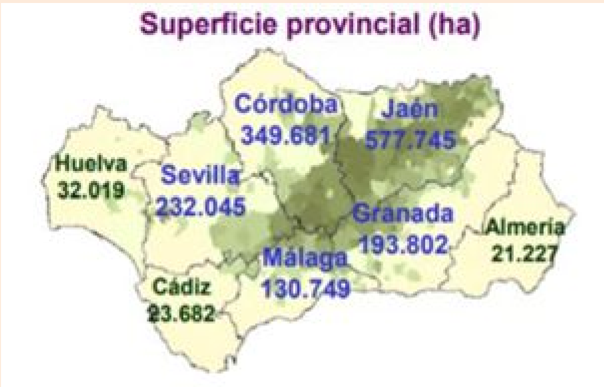
It was stated that it would be interesting to aggregate climate-related information according to olive zones.

Question: Which are those olive zones? Would DCOOP be able to provide a GIS raster map of "*zona oliveira"?*

Answer:

These olive zones are 5 of the 8 provinces of Andalusia: Jaén, Córdoba, Granada (at least the North of Granada), Málaga (at least the North of Málaga) and Seville (at least the Northeast of Seville) (Fig.4-8).

Figure 4-8. : The olive zone is the dark green area on the map.



According to the information of 2017 from Government of Andalusia [RD 3], its 8 provinces make 1.560.950 Ha of olive crops but 5 provinces (Jaén, Córdoba, Granada, Málaga and Seville = 1.484.022 Ha) concentrate 95% of hectares of olive crops in Andalusia.

We could classify the provinces according to their number of hectares to the Andalusian total:

1º) Jaen: 577.745 Ha (37,01 % of Andalusia)

2º) Cordoba: 349.681 Ha (22,40 % of Andalusia)

3º) Sevilla: 232.045 Ha (14,86% of Andalusia)

4º) Granada: 193.802 Ha (12,41% of Andalusia)

5) Málaga: 130.749 Ha (8,37% of Andalusia)

6) Huelva: 32.019 Ha (2,05 % of Andalusia)

7) Cadiz: 23.682 Ha (1,51% of Andalusia)

8) Almeria: 21.227 Ha (1,35 % of Andalusia)

Regarding the request of providing a GIS raster map of “zona olivarera” DCOOP suggested that a good source would be the Web GIS for the identification of agricultural plots (SIGPAC) developed by Junta de Andalucía (the Government of Andalusia), through the collaboration with the Spanish Agricultural Guarantee Fund (FEGA). It is used as an element of the Integrated Management and Control System for EU Common Agricultural Policy.

SIGPAC is freely available to users for download subject to proper citation and attribution of authorship to Junta de Andalucía (©Junta de Andalucía).

Issue 7

It was asked whether there will be a final tool and, if yes, what that will be.

Question: It would be nice if DCOOP could provide indications and ideas for functionality for the interactive dashboard.

Answer:

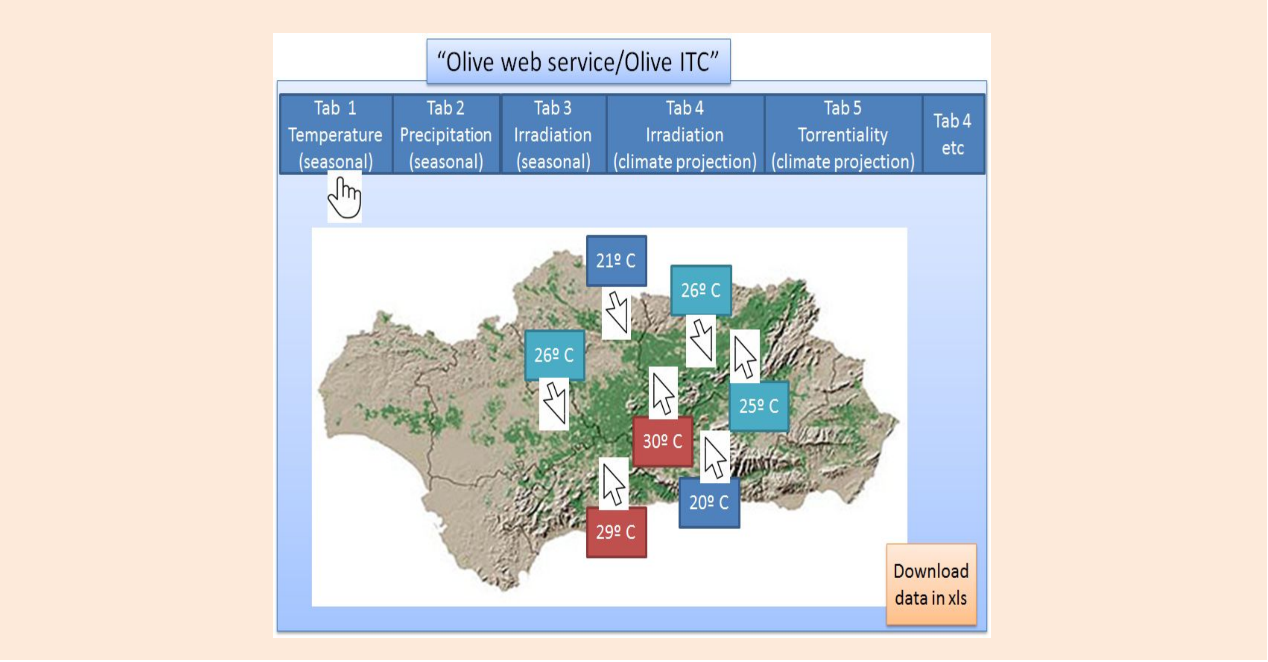
DCOOP identified the most relevant features that could be included in the tool for the olive sector:

- Georeferenced map of the olive-growing areas of Andalusia.
- Access to the climate forecasts at the plot/farm level by clicking on each farm.
- Download data in table format (Xls) or similar for every farm or a group of farms or all “Olive area”/Andalusia.

- Presenting one map per variable studied (temperature, precipitation, bioclimatic indices...).i.e. the tool might have several tabs on the web platform that allows access to different maps of the diverse study variables of WP2.

These features are summarized in Fig. 4-9, in which DCOOP has tried to express a possible kind of design for the olive tool.

Figure 4-9: Example of design for olive tool.



Issue 8

Identifying decision-making processes in DCOOP.

Because DCOOP is a second-degree cooperative that is the result of joining first degree cooperatives, in turn, the first-degree cooperatives are the results of the joining together of farmers; there are several types of users in the decision-make process.

DCOOP has tried to identify and summarize the main actors, moments and the key decisions that could be carried out during the olive campaign:

1. Phytosanitary treatments. All year (from September to September of the following year). Farmers and Technicians. The farmers and/or technicians have to monitor pests diseases and phytosanitary treatments.

2. Soil management. All year (from September to September of the following year). Farmers (sometimes technicians) Farmers (and if farmers want) a technician can advise them during the year to do several activities in the soil such as tillage, vegetation cover management…

3. Commercialization products, All year (from September to September of the following year). DCOOP (second degree cooperative). DCOOP has to manage the storage of the final products (in this case olive oil and table olives).

4. Opening the olive mills and picking facilities. September/October. First degree cooperatives and farmers. The first degree cooperatives in Assembly in which take part the farmers or by a meeting in which participate the representatives of the farmers (these people usually are farmers) in the first degree cooperatives, they agree the date to open the facilities where farmers can carry the olives. Each first degree cooperative set its date.

5. Harvesting moment. From September/October to March/April. Farmers. The farmers decide the date to harvest. Some variety of olives can be used for olive oil and table olives hence in these cases the farmers must decide the use because the olives for table olives are harvested earlier than olives for olive oil. The olives for table olives have to fulfill a determinate size and visual appearance.

6. Transforming olives. September/October to March/April. First degree cooperatives. Once the olives are received in the first-degree cooperative, the raw materials (olives) have to be transformed into the final products (olive oil or table olives) in the facilities of these first degree cooperatives.

7. Fertilization. October/November. Farmers (sometimes technicians) The farmers and (if the farmers want) the technician can advise the farmers to decide the main issues of fertilization such as the moment to apply, the most appropriate fertiliser, the type of fertilizer, the method of application…

8. Selling the fertilizers. October/November. First-degree cooperatives. Usually, first degree cooperatives have a shop where the farmers can buy fertilizers and the tools necessary for this task.

9. Buying the fertilizers and distributing to first degree cooperatives. October/November. DCOOP (second degree cooperative). DCOOP offers the services of buying fertilizers to the first degree cooperatives which require these services.

10. Pruning. From February/March to May/June. Farmers (sometimes technicians) Farmers and (if farmers want) technicians can assist them with the pruning.

11. Fertilization. From February/March to May/June. Farmers (sometimes technicians) Farmers and (if farmers want) technicians decide on fertilization options such as the moment to apply, the most appropriate fertiliser, the method of application, etc.

12. Selling the fertilizers. From February/March to May/June. First degree cooperatives. Usually, first degree cooperatives have a shop where farmers can buy fertilizers and the tools necessary for this task.

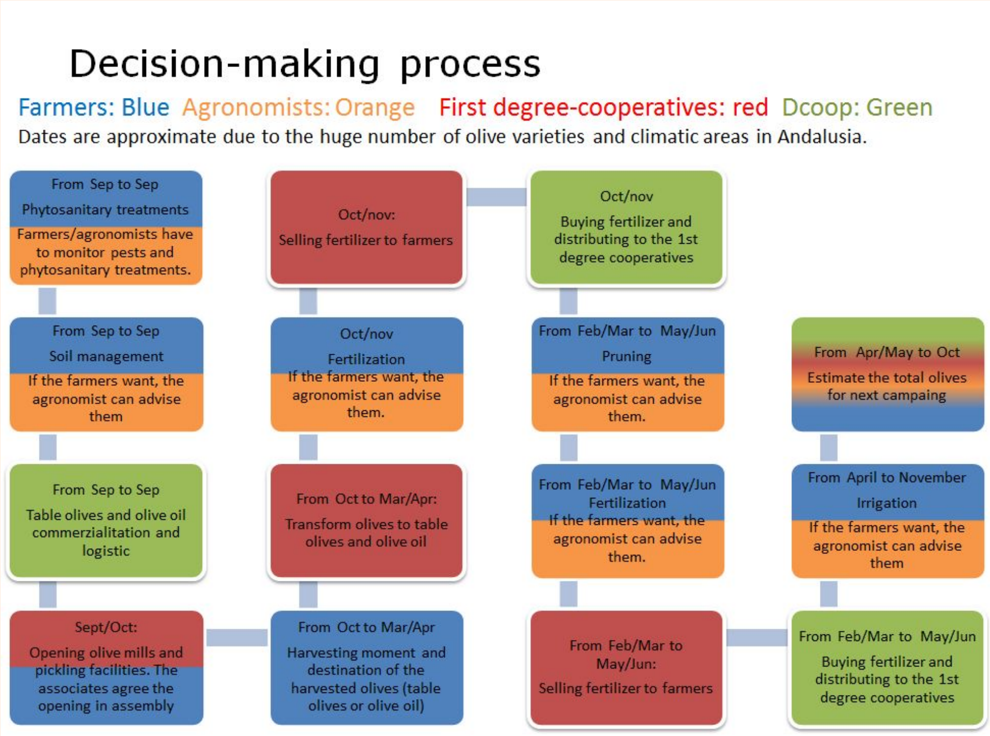
13. Buying the fertilizers and distributing to first degree cooperatives. From February/March to May/June. DCOOP (second degree cooperative). DCOOP offers the services of buying fertilizers to the first degree cooperatives which require these services.

14. Irrigation. From April to October/November. Farmers (sometimes technicians) Farmers and (if the farmers want) technicians decide on irrigation options.

15. Estimating total production of the campaign. From April/May to October. Farmers, technicians, First degree cooperatives and DCOOP (second degree cooperative).

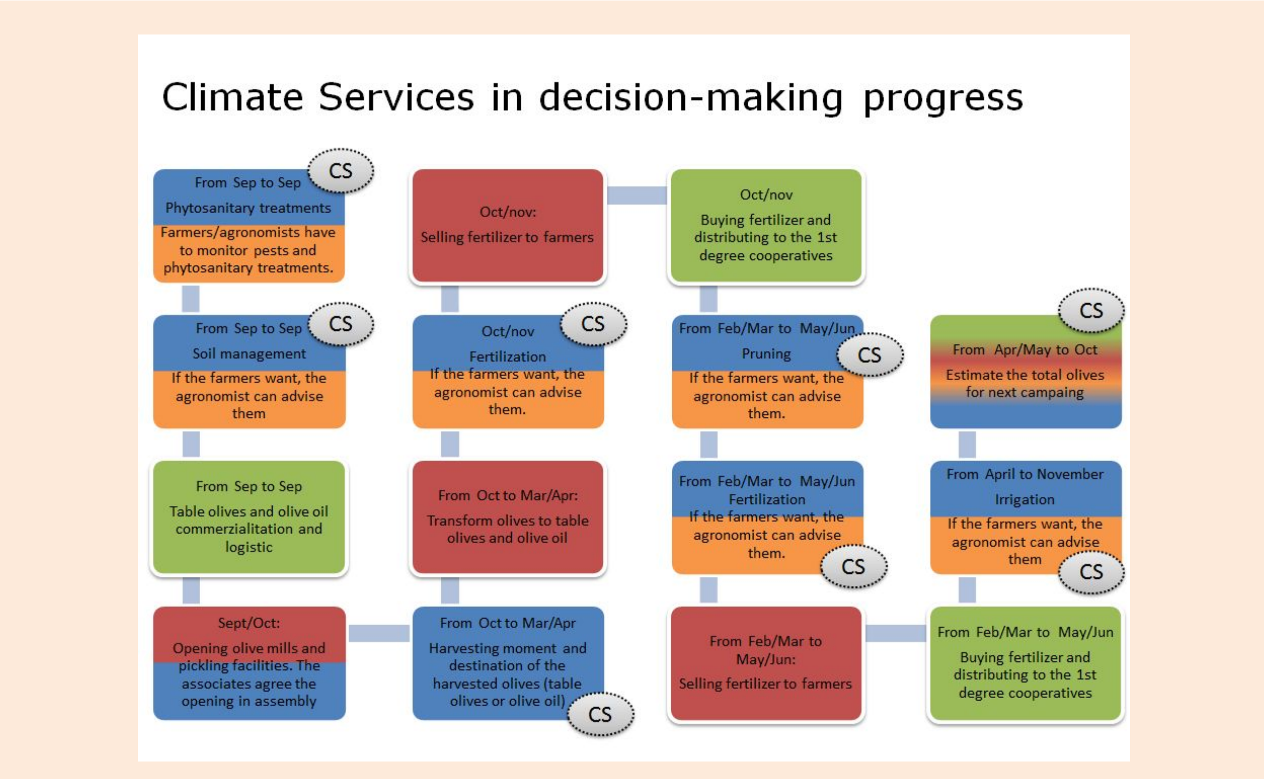
Fig. 4-10 shows the approach of decision-making in DCOOP and its different levels of action:

Figure 4-10: Decisions made during the campaign and actions involved.



According to DCOOP's experience the key decisions 1, 2, 5, 7 10,11, 14 and 15 might be assessed to check if the climate services could assist the users to improve their decisions:

Figure 4-11: Decisions where climate information could play a role.



Issue 9

This issue is divided into several specific questions that arose during the FC.

1) **Is there an interest in long term pest risk for the olive growing areas/provinces?**

The graphic of olive fly and Olive fruit weight, shown during the FG through the PMBD, was difficult to understand and it was suggested that farmers and technicians won't be able to use it to prepare the phytosanitary treatment. It seems that the olive sector is interested in the short term than the long term regarding olive fruit fly risk. Participants commented that this information wouldn´t be useful for farmers and technicians, at least, if this information is provided like it was during the FG.

2) **Regarding the possible interest of other actors of the value chain such as producers of phytosanitary products in the outcomes from PBDM,**

From DCOOP's point of view, the phytosanitary is produced or not according to the interests/needs of the producers. The olive fly pest exists all years, however, the insecticides usually vary every year. However, this opinion should be verified by other actors in the value chain.

3) **Please elaborate more on the difficulties and laws that affect chemical product storage in Spain.**

   Every phytosanitary product must apply for its authorization to the government of Spain, once approved, the product is included in the official register of phytosanitary products and it can be sold and used. The authorization for each product has an expiration date (each product has a specific lifetime). Once the authorization expires, a new one must be requested. For this reason, the official register changes every year, new products appear and others disappear. Also, if the product changes in its composition or any of its active substance is banned, the product will not be legal anymore and must change its composition and request a new authorization. On the other hand, the storage of this type of material requires a series of specific fire and storage permits that make difficult to store the product for several months. Also, each product can specify its storage condition. However, these suggestions should be verified by other types of actors in the value chain.

4) **Please provide more detail on the decision-making process of local authorities that might control phytosanitary treatments**

   The treatment is authorized by the technician and the farmer who must make every task according to the law (a phytosanitary treatment can´t be applied without having the required proofs to do it). The local authorities can carry out inspections to control that the farmers and technicians have made the tasks according to the law.

5) **Has DCOOP considered the potential usefulness of seasonal forecasts in improving area-wide IPM coordination of farmers in the different provinces of Andalucia (e.g., at the oil mill level)?**

   DCOOP has a service of technicians for the farmers in the first degree cooperatives (oil mill), the technicians manage these areas of cultivation and advise the farmers. DCOOP believes this information isn´t useful or at least expressed as a graphic like the one presented during the FC.

<u>Issue 10</u>

The point of heavy rainfall events (torrentiality) was raised.

Question: Please, provide the operational definition of a torrentiality index as well as a clearer description of the decision-making process.

Answer:

The operational definition for torrentiality at a seasonal scale could be the amount of precipitation per time unit on rainy days from October to May (8 months) in the olive areas of Andalusia. Seasonal forecast of 6-12 months in advance.

However, this definition is not complete, it should set a range of precipitation and time; we have to set the threshold for a rain short (in time) but high/strong (in the amount of water) and long (in time) but soft (in the amount of water). For example, 20 L of rain in 10 min and 500 L of rain in 24 hours could be equally harmful for the soil. Also, it should be associated with the slope and the soil absorption capacity of each farm.

If Torrenciality can be combined with slope maps of Andalusia and information on the amount of water that can be absorbed by each soil, it could know:

- On the one hand, it would allow us to know the amount of precipitation that infiltrates into the soil (water available for the olive trees) and how much water forms a surface runoff (water not available for the olive trees). This would allow us to know how much water the trees might use. For example, a day that rains 50L in 10 minutes, but only 10L have infiltrated the soil (water that could use the olive tree) while 40 L has been overflowed (this water can´t be used by the olive trees). In conclusion, it has rained 50 L, but the olive can only use 10 L. so we can say that the real precipitation for the olive trees was 10 L.
- On the other hand, it is interesting to know the soil loss caused by torrentiality. An example is fertilization, for example, in a hypothetical situation where the risk of torrentiality is very high in March, in that case, the farmer could choose to delay fertilization and spring pruning to reduce soil loss and loss of fertilizer applied. The farmer could base the choice of the type of fertilizer (solid, liquid) or route of application (fertigation, foliar...) based on torrentiality.

Torrentiality seems to be a useful long-term variable if it can be related to soil loss. It could be studied if it can be combined with some soil loss equation such as USLE (https://en.wikipedia.org/wiki/Universal_Soil_Loss_Equation).

Maybe this information could be useful to farmers. For an olive farm that in 10 years will have problems with extreme soil loss, the farmer could take actions to avoid soil loss. For example, applying permanent vegetation cover, avoiding tillage, making less intense pruning or making it in periods where the rain is less torrential.

A hypothetical definition of torrentiality in long-term (although we don´t know if the farmer would use this climatic information) to use: the amount of annual soil loss (if this is a measurable factor by MED-GOLD) of a farm regarding long-term forecasts (10-20 years in advance). The climate projection data could be referenced to the current data. For example, a result that indicates the % of variation in soil loss expected for the next 10 - 20 years in order for the farmer to know whether it is necessary to take actions in the coming years to decrease the soil loss (as a permanent plant cover). It should be noted that however useful this index would be, it is not feasible to be included in the tool due to the inability of climate models to adequately simulate this parameter. However, other related parameters can be simulated in climate projections such as the number of days with extreme precipitation (exceeding certain thresholds).

5. Olivia platform

Olivia is a web platform that includes a predictive pest management support system based on artificial intelligence that is available to farmers. It focuses on the shorter time scales of weather forecasts as a response to the users' needs, as reported in the previous rounds of interaction. More details will be included in the forthcoming Deliverable 2.2.

It was an invivo campaign through 2019 from the end of June to the end of November, providing insights on pest evolution for the following 4 weeks based on climate, agronomic and geographical data.

Throughout the campaign it was serving 380,000 ha in eight provinces in Andalucía, providing a tool to manage efficiently and under sustainable conditions more than 191,000 farms, and it has been used by more than 220 technicians integrated in APIS (integrated production).

The tool has been widely tested, the local government has supported it, and is well known in the sector as the most advanced tool for pest control.

The dashboard could - in a geolocalized area - show the pest risk in each parcel.

Figure 5-1: Olivia Platform: Regional Manager role vision. Andalucía region.

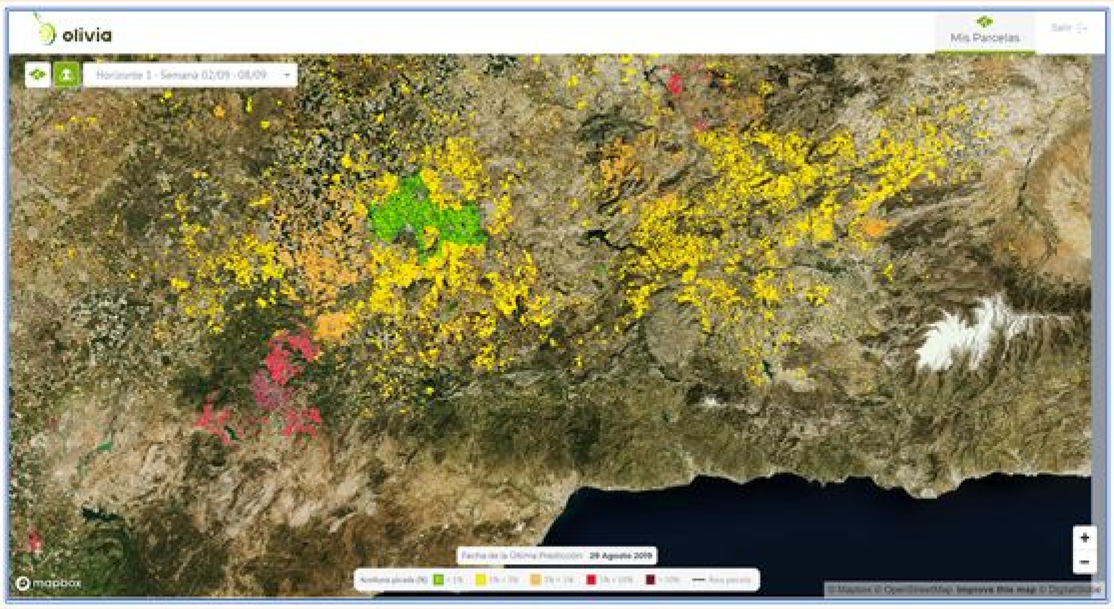
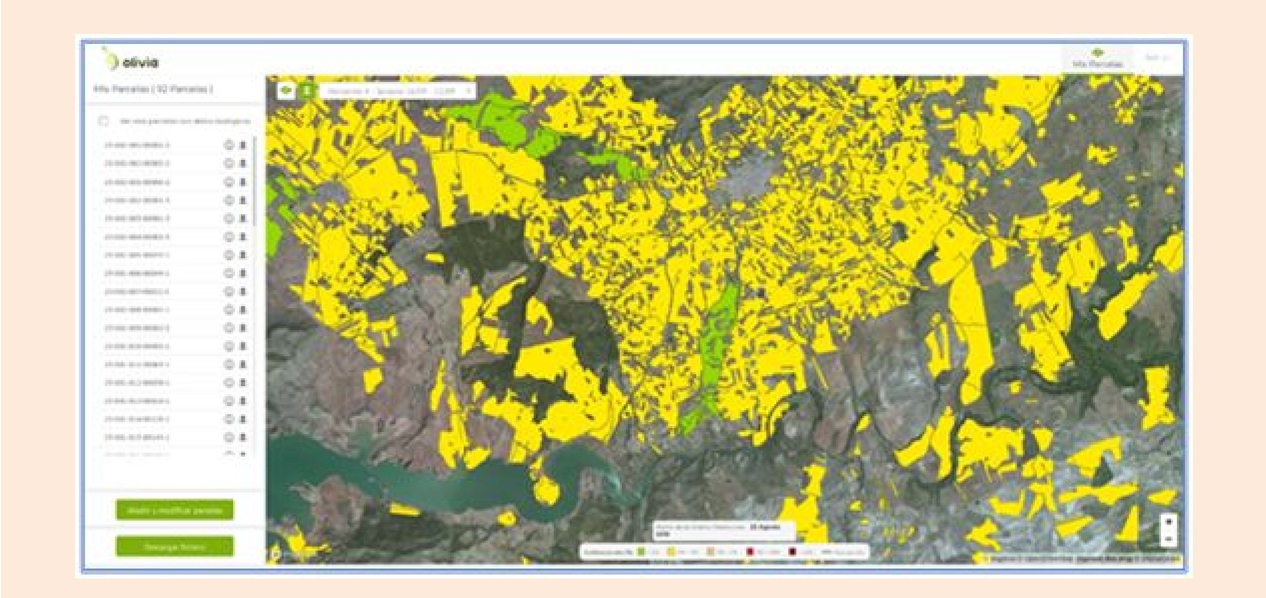


Figure 5-2: Olivia Platform: Technician role vision. Cordoba area.



5.1. Feedback from users

WP2 designed two types of material to engage the participation from end-users and collect their feedback regarding the Olivia platform:

1. Flyer. (Annex A)
2. Online survey. It includes 21 questions and was sent to agronomists in Andalusia who had access to the Oliva platform during the progress of the olive fruit fly pest in 2019.

The feedback survey consists of a list of 21 questions and was completed by 26 end-users. The responses and comments collected through the survey are presented in this section. Some answers, which were in the form of agree/disagree are summarised in Table 5-1 and shown in Annex B.

Question 1: Have you been accessing the Oliva platform every Friday, as scheduled during the testing period?

Almost 40% of the participants answered ’yes’, 10% ‘no’, 25% ‘not sure’ and 20% ‘other day’. One participant commented that sometimes the platform was not accessible.

Question 2: I could access the Olivia platform easily.

The answers are shown in table 5-1.

Question 3: There was no problem in accessing or downloading data from the Olivia platform.

The answers are shown in table 5-1.

Question 4: The results from the Olivia platform were easy to understand.

The answers are shown in table 5-1.

Question 5: The navigation through the Olivia platform was easy and fast.

The answers are shown in table 5-1.

Question 6: The hints and the explanatory texts provided by the Olivia platform were enough to understand how to use the platform and to interpret the results.

The answers are shown in table 5-1.

Question 7: The map from the Olivia platform was easy to understand.

The answers are shown in table 5-1.

Question 8: I easily identified my farm(s) on the Olivia platform.

The answers are shown in table 5-1. One participant commented that the farms shown on the platform do not correspond to the real ones.

Question 9: What did you like most in the Olivia Platform?

Most of the participants focused on the fact that the platform is easy to use. They also liked the visualisation of the farms' data and that all the parcels are gathered in one place. A very important asset of the application that was highlighted by the end-users is that it helps in decision making about the pest treatment and the sustainable use of the phytosanitary products. The short-term forecast (3-5 days) is very useful to them.

Question 10: What did you like least in the Olivia platform?

Some participants (3 out of the 15 who answered this question) commented on the validity of the forecasts, saying that the predictions are not reliable. However, some others, being satisfied with the predictions, say that they would be more satisfied if more pests (apart from the olive fly) were included in the tool. Four participants expressed their dissatisfaction about the selection of the farms; either they face difficulties in locating a specific farm or they would like to have results for more than one farm at the same time. The legends were also an issue; they should be easier to interpret. The connection problem which appears sometimes was also mentioned as a drawback of the platform.

Question 11: I am satisfied with the forecasts of the pest evolution because the % skill is very high even 4 weeks in advance.

The answers are shown in table 5-1. A participant commented that the skill was higher than he/she expected.

Question 12: I used the forecasts of the olive fruit fly evolution from the Olivia platform in order to improve my orders and treatment recommendations.

Almost 40% of the participants answered ‘yes’, 50% ‘no’ and almost 10% expressed no opinion.

Question 13: If you gave a positive response to the previous question, could you please describe how you used the information provided by the Olivia platform so as to decide on the treatment recommendations (which information you used and for what type of recommendation)?

The answers were not very specific. Most of the participants focused on the fact that the application helped them in making the treatment plans and choosing the best date for making the treatment orders. Some of them confirmed the predictions through field observations. It was also used as a mean to persuade the farmers to follow their recommendations.

Question 14: How effective were the recommendations (e.g. did they help in reducing the damage in the olive groves?)?

According to the participants it is not possible to quantify the result of the recommendations. Overall, however, the recommendations after taking into consideration the application’s data, were very effective mainly in determining the best moment for applying the treatment. It also helps the farmers to be more prepared in terms of necessary machinery and products.

Question 15: In addition to the treatment recommendations, have you used the Olivia platform for helping you in your daily activities?

The majority of the participants (68%) gave a negative answer. Almost 20% answered 'yes' and 14% expressed no opinion.

Question 16: If gave a positive answer to the previous question, please describe how you used the Olivia platform as an additional aid for your daily activities.

Only two answers were given in this question; i) climate data and ii) as a database.

Question 17: I would use the Olivia platform, if it becomes available in the future.

The answers are shown in table 5-1.

Question 18: Would you change something in the Olivia platform? If yes, what would you change?

The following suggestions for improvement were made:

i) The platform could warn the users by SMS or whatsapp.

ii) It could include more pests, apart from the olive fly.

iii) It could provide more pest or agronomic parameters.

iv) It could provide a more flexible farms' identification.

v) The plots need to be updated and include more regions.

vi) The 'field notebook' could be added in the platform.

Question 19: Would you pay to use the Olivia platform?

Half of the end-users were negative. 27% said ‘yes’ and 23% expressed no opinion.

Question 20: Would you recommend the platform to other technicians or farmers?

The majority (more than 70%) answered ‘yes’, 23% ‘no’ and 5% expressed no opinion.

Question 21: Overall, how would you rate the Olivia platform?

The average rating is 3.3/5.

Table 5-1 Answers to certain questions of the feedback survey.

	Q2 (%)	Q3 (%)	Q4 (%)	Q5 (%)	Q6 (%)	Q7 (%)	Q8 (%)	Q11 (%)	Q17 (%)
Strongly agree	50	23.1	26.9	30.8	26.9	30.8	23.1	13.6	22.7
Agree	30.8	50	53.9	53.9	42.3	57.7	50	22.7	63.6
Neither agree nor disagree	11.5	7.7	19.2	7.7	30.8	11.5	19.2	36.4	4.6
Disagree	7.7	15.4		7.7			3.9	27.3	
Strongly disagree							3.9		
I don’t know/I have no opinion		3.9							9.1

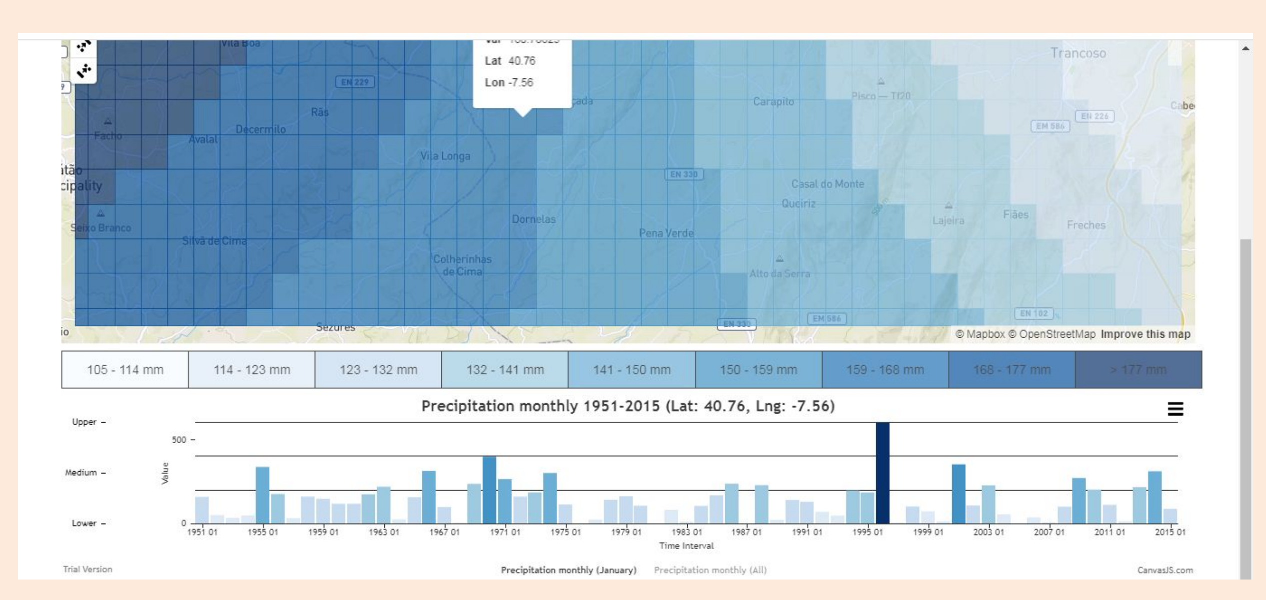
6. Dashboard

The MED-GOLD dashboard (https://dashboard.med-gold.eu/) is a web-based application that allows the users to easily visualise, interact and even download climate data and indices. Support and documentation for nontechnical users is under development and will be based on the project glossary (https://www.med-gold.eu/glossary/).The dashboard was designed and created as a response to the need expressed by the users during the previous focus group, for an easy and interactive way to visualise and download tailored data. More details about the Dashboard are reported in Deliverable 3.7. The application is in a trial stage for the olive/olive oil sector, thus the evaluation is mostly in the form of comments/suggestions for improvement provided by DCOOP users. A PDF snapshot of the current state of the document that includes specifications for the dashboard is available at this link https://drive.google.com/open?id=12wi3530EmhuPHX-ERlW2jBOUeqUNFbG2). Work Packages 3 and 4 (for wine and durum wheat, respectively) also provide an evaluation of the tool in deliverables 3.7 and 4.7 [RD20], [RD21]. Work Package 2 contributed to the development of the dashboard (see below) and provided a first visual specification for it in August 2019 (see section 4 in the present document).The comments 1-4 presented in the next paragraph refer to suggestions that were made by main contact point of DCOOP in the MED-GOLD project during the development of the application. Apart from this evaluation, a virtual demonstration to end-users of DCOOP also took place on May 6th 2020 and the results are presented in the “users’ feedback” section which follows.This demonstration was based on the meeting on 29/04/2020 carried out by the Dashboard team in which one of DCOOP's potential users attended it accompanied by the DCOOP's main contact with MED-GOLD.

Comment 1: The historical climate data is exported in file formats (.json, .nc) that are not friendly for the end-users (agronomists, farmers or others actors in the olive oil value chain) who are familiar with simpler file formats. Also, it would be more user-friendly if the zoom on the map could be done by scrolling rather that by clicking the (+) and (-) buttons.

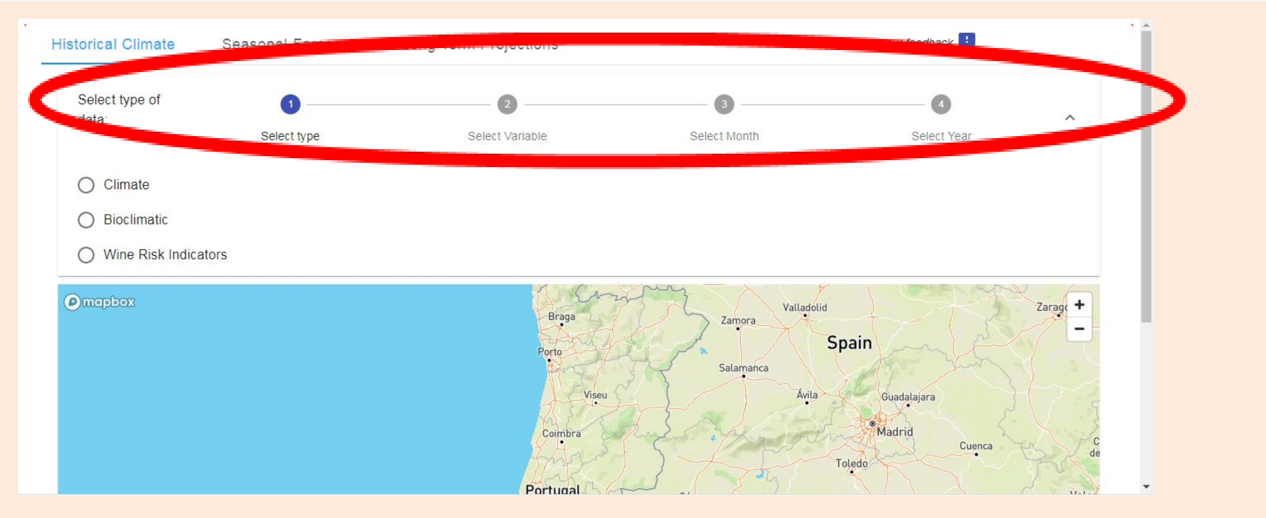
Comment 2: It would be better if the colourbar for the precipitation was moved to the left or right side of the map. This way, it will be more clear that it refers to map and not to the bar plot right below (Fig. 6-1).

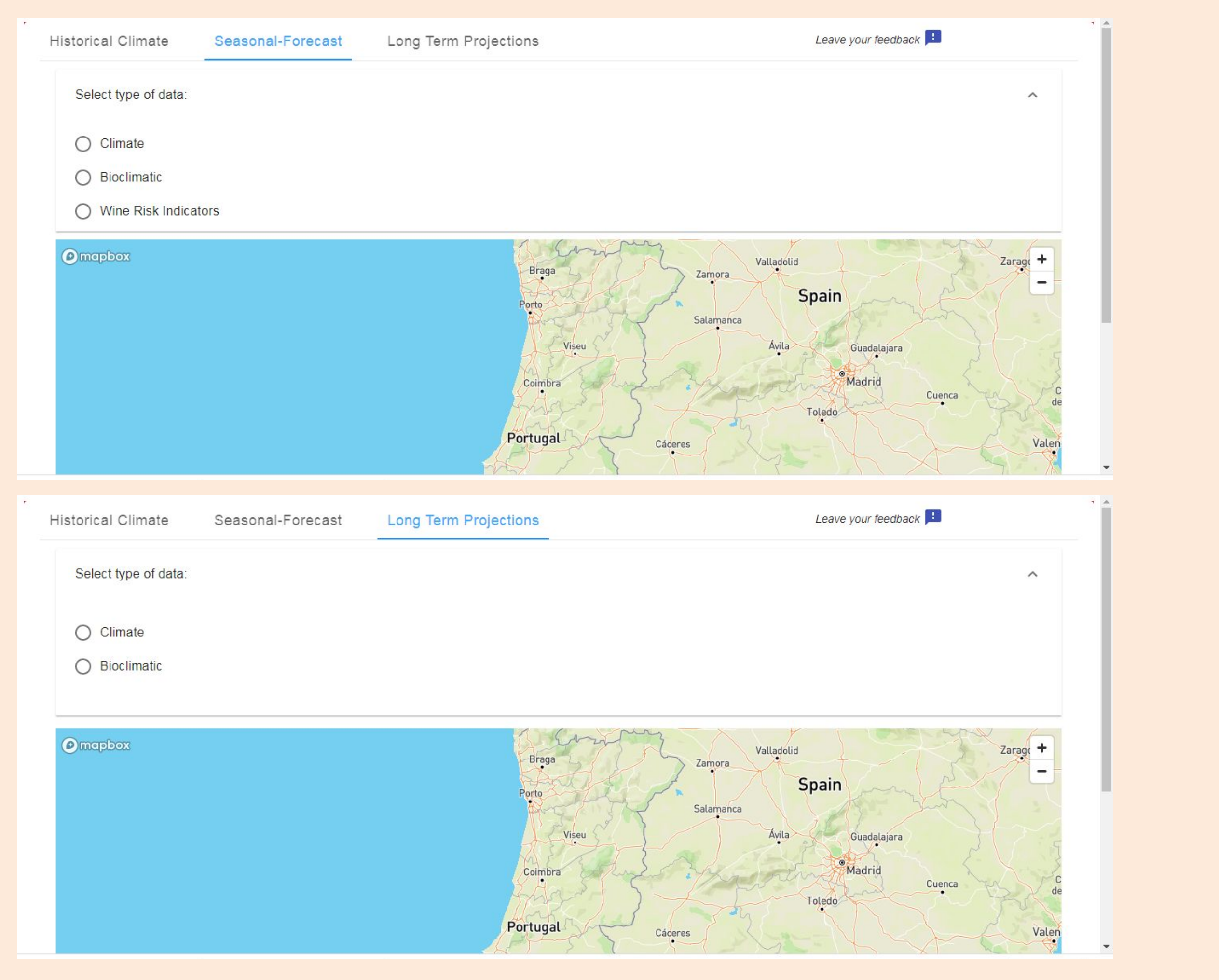
Figure 6-1: Map and bar plot of precipitation as shown on the dashboard.



Comment 3: At the first tab of the dashboard (Historical Climate), there is guidance for the steps that the users should follow in order to get the desired result, which is very helpful. However, these steps are missing for the next two tabs (Seasonal Forecast, Long Term Projections) (Fig. 6-2). Also, what about adding an additional step in the end, "select point on the map"?

Figure 6-2: Dashboard tabs.

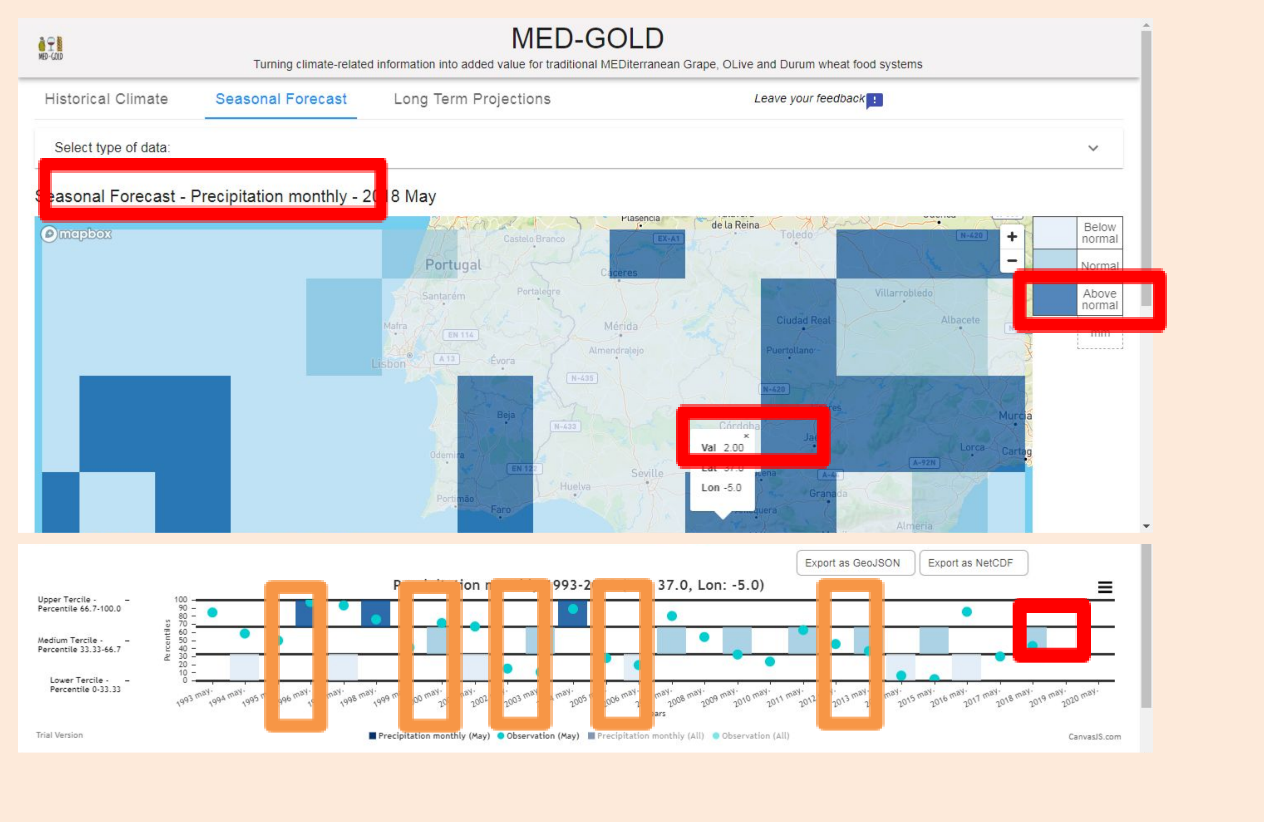




Comment 4: When the option "monthly precipitation seasonal forecast" is selected, the values do not correspond to the right colour (Fig. 6-3). Also, in some cases (years) the bar plots for the seasonal forecasts do not appear.

It should be noted that some bugs of the Dashboard reported in this section have already been fixed.

Figure 6-3: Dashboard snapshots.The red boxes highlight the difference between the numerical value (2) and blue tone (this tone means a value of 3), however, both should represent the same value. On the other hand, in the bar graph for the seasonal prediction is not shown for some years.



6.1. USERS´ FEEDBACK

In this section, a summary of the users' feedback virtual meeting is presented. The demonstration regarding the MED-GOLD Dashboard was held on 06/05/2020 to 4 people of Dcoop and was presented by one of the Dcoop people that attended the Dashboard meeting carried out on 29/04/2020.The feedback is divided to 3 types:

-Comments done by the participants, indicated in the text as **(C).**

-Questions done by the participants, indicated in the text as **(Q).**

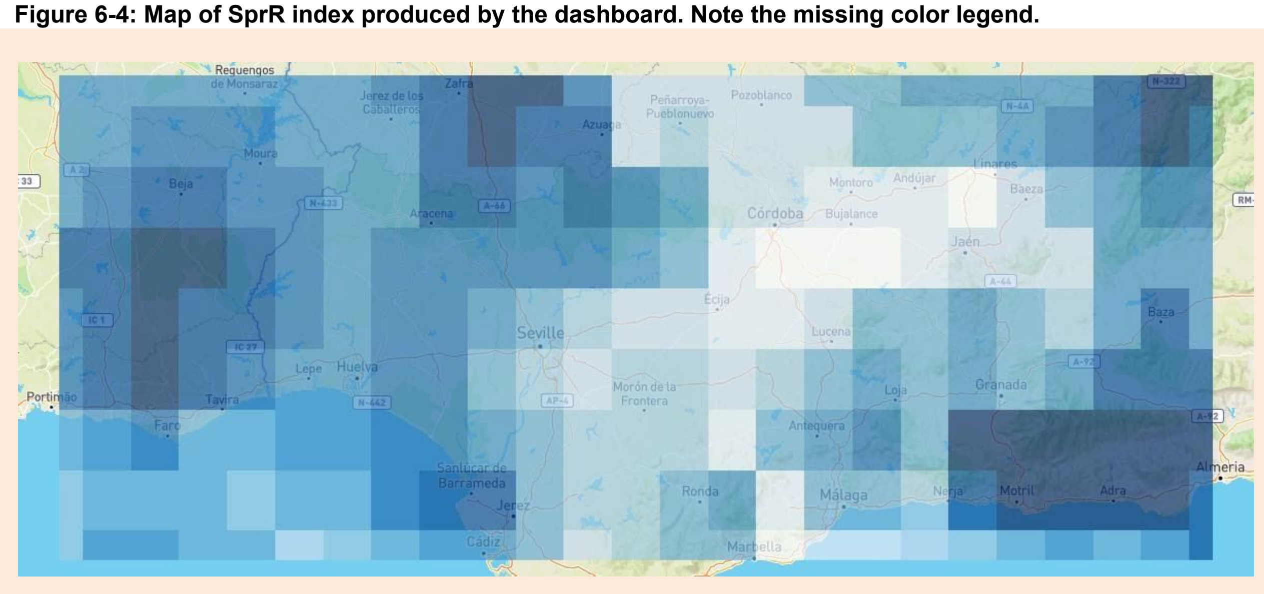
-An error that appeared during the demonstration, indicated in the text as **(E)**.

Users´feedback on the Historical Climate Section:

During the demonstration, the participants were not able to see any information or data for the Climate section due to a Dashboard error**(E1).**

In the Bioclimatic section, the SprR bioclimatic index for 2018 was shown as an example. The Dashboard produced a colour map in jpg format (Figure 6-4). The participants noticed that a colour legend is missing in the figure. They also commented that in some cases - like this - it is difficult to look at the map in the background **(C1)**.

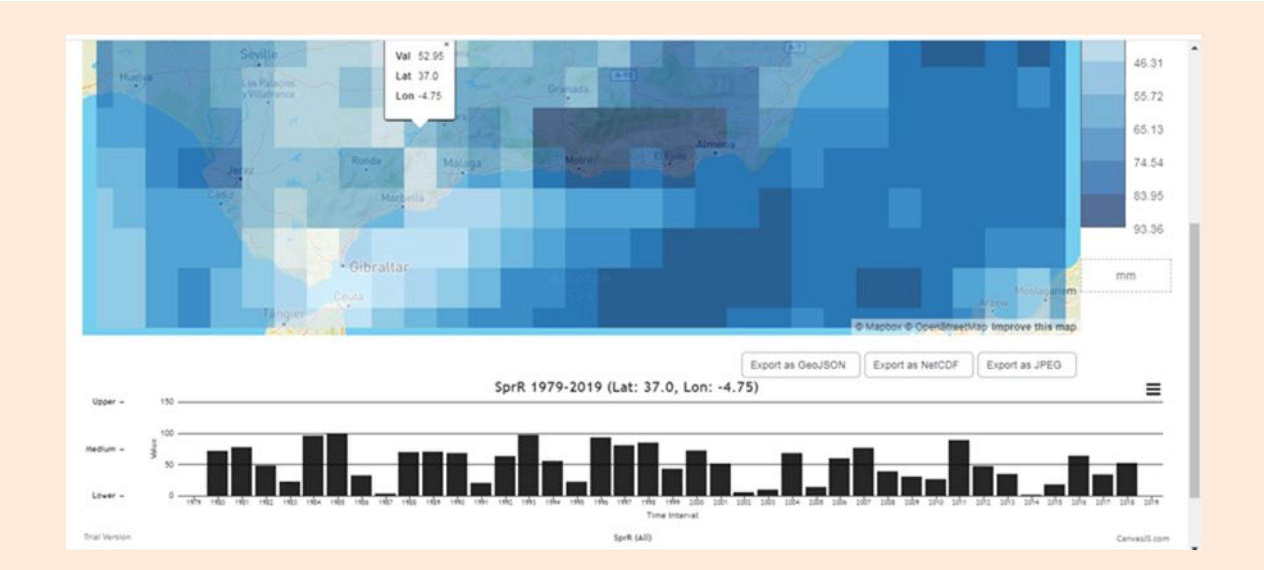
Figure 6-4: Map of SprR index produced by the dashboard. Note the missing color legend.



Regarding the data output, the participants were not able to open the GeoJSON and NetCDF produced files. The participants mentioned that they do not recognize these formats and that they would prefer an excel file **(C2)**.

When the requested map is shown on the application, the option to select a location is provided to the users. In our case, a location near Antequera (Malaga, Spain) was selected. The participants suggested the creation of a new option that would allow users to export something similar to what is shown in figure 6-5**(C3)**.

Figure 6-5: Suggestion for exporting the requested information (colour map + legend of value from the colour + graphic and the value of this graph).



The participants are interested in getting the results for each year in a spreadsheet format **(C4)**.

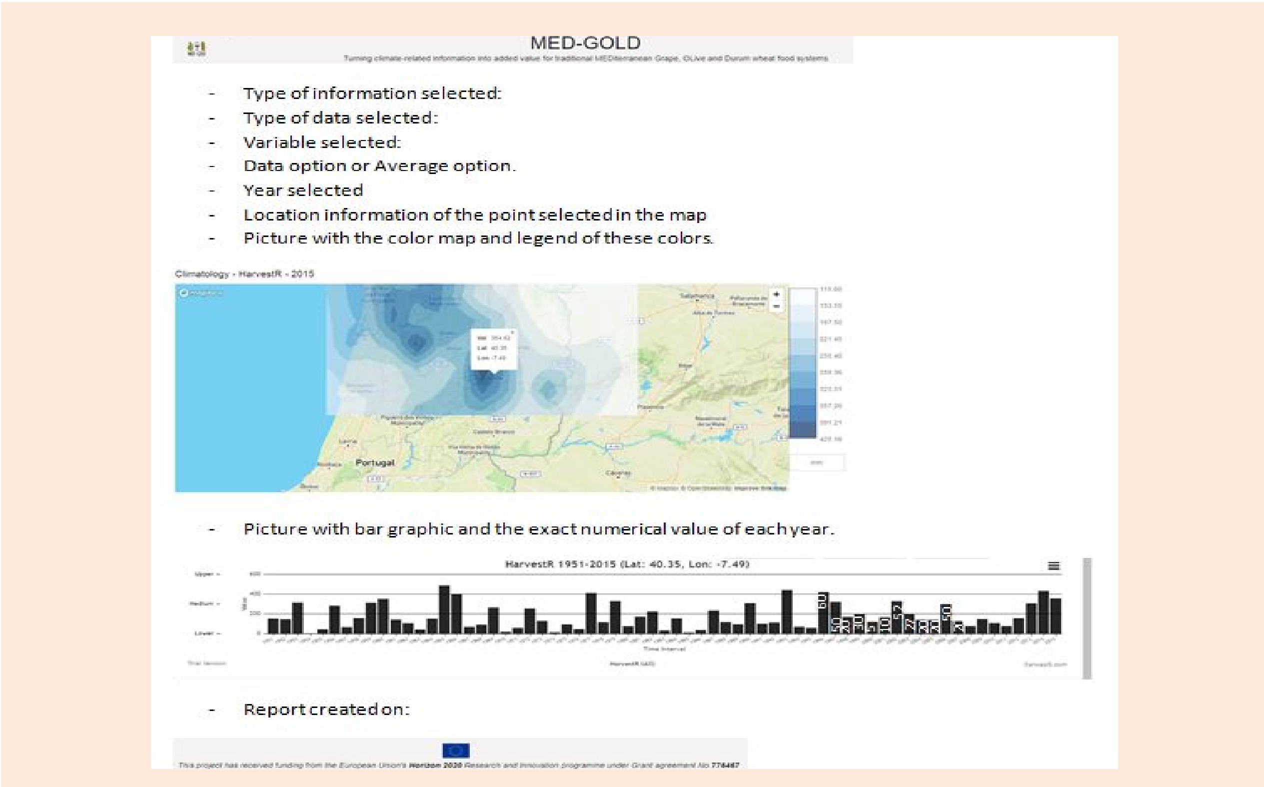
They also suggested a more attractive graph to be downloaded in JPG format. Maybe the bars could be coloured in different tones of blue according to their value. The exported figures could also indicate some more key information, such as data type and climatic variable selected **(C5)**.

The participants believe that the Dashboard should include an option to create a report. This option could be available when the bar graphic is generated. The report should automatically collect all the information of the steps followed by the users to get the bar graph (before downloading the report):

- MED-GOLD logo
- Type of information selected: Historical Climate or Seasonal Forecast or Long term projections
- Type of data selected: Climate or bioclimatic or Wine Risk Indicators.
- Variable selected: (precipitation monthly….GTS, SprR… sanitary risk…)
- If the user has selected the option of Data or Average
- The year selected
- Location information of the point selected in the map
- Picture with the colour map and legend of these colours.
- Picture with bar graphic and the exact numerical value of each year (maybe it should be shown in a table in a spreadsheet if in the graphic this information can´t appear due to the little space available).
- Report created on: (showing the actual date)
- EU logo.

Figure 6-6 shows an example of how a report could look like **(C6)**.

Figure 6-6: Suggestion of how a report could look like.



Once the historical climate panel was explained, the participant asked several questions:

(Q1) Currently, the tool provides data until 2018. Will MED-GOLD integrate the historical data of 2019 in the Dashboard? Accordingly, will the data for 2020 be on the Dashboard next year?

(Q2) Does MED-GOLD Dashboard automatically load information of data sources that the Dashboard uses to produce results? In other words, if the olive sector accesses the Dashboard the next year, is the data and information for 2020 updated automatically?

(Q3) Which are the data sources of the Historical Climate Panel in the Dashboard?

(Q4) What is ERA5?

(Q5) Can DCOOP have access to the data sources that the Dashboard is using to provide the Historical climate data? If yes, could the data sources be downloaded in the form of spreadsheets, for example, Excel?

(Q6) Will the indices that were suggested as suitable for the olive sector during the previous Focus Group, be available in the final version of the Dashboard? If yes, when? Are these indices already calculated?

The participants suggested the two new bioclimatic indices to be included in the Dashboard, if possible: the total precipitation from September to October and the number of hot days from September to October **(C7)**.

(Q7) Could the evapotranspiration (ET) be calculated for the seasonal forecast for spring and autumn?

Regarding the risk of olive fruit fly attack, the end-users suggested the inclusion of the number of hot summer days (T>40º C) in the Dashboard **(C8)**.

(Q8) Could the Dashboard include the thermal sensation index that was suggested in the previous Focus Group, in the historical climate panel?

Users´feedback on the Seasonal Forecast Section:

This tool section was more complex for the users than the historical climate because they do not know this type of climate services or analysis. The participants needed more assistance to understand the information that is shown in the application. **(Q9)** Could MED-GOLD explain about the method and meaning of the seasonal forecasts?

According to the technicians that participated in this demonstration, the Dashboard doesn't seem to be very useful for farmers. The team of DCOOP agronomists works at the short term time scale by using weather forecasts, therefore this tool would not provide added value to this team. However, the Dashboard could be useful for the department of olive logistics from DCOOP. DCOOP must check if the results of the dashboard can contribute to the improvement of the forecast regarding olive oil for the next season. DCOOP believes that the tool should be tested by the department of olive oil logistics in order to assess and analyze its usefulness. All the above apply to the case that the indices for the olive sector are included in the tool.

The participant suggested the definition of the bioclimatic indices**(C9)**.

In the seasonal forecast panel, 2 bioclimatic indexes were shown to the participants as an example (Sptx and SprR). The Dashboard calculates a value to indicate the tercile (normal, below or above) of the seasonal forecast, but the forecast doesn´t provide a value of the estimation, for example, +10% (above normal) or -10 (below normal).The participants suggested that the Dashboard should show the average value which is considered as normal for the selected variable in order to make it more comprehensible for the users. For instance, in SprR participants didn´t know what the normal value is **(C10)**.

(Q10) Could the seasonal forecasts provide absolute values or a percentage of increase/decrease of the climatic or bioclimatic variables? Another option could be that the dashboard defines a range of temperature in each tercicle. For instance, what temperatures are a) above normal, b) below normal and c) normal. Could the Dashboard use a range of temperatures in each tercile?

The average value should be indicated in the legend of the graph because the users don´t know the average of the previous years **(C11)**.

The participants suggested the use of the percentages in the seasonal forecasts. The users might check the % provided by the Dashboard and decide if they trust the results **(C12)**.

(Q11) Could the dashboard calculate and show the thermal sensation in the Seasonal Forecast panel?

Users´feedback on the Long Term Projections Section:

The participants didn´t identify any key decision that DCOOP would need in the long term.

There are 3 time periods available for the Long Term Projections: 1971-2000; 2031-2060 and 2071-2100. The participants wondered why there are years which are not included (2001-2029 and 2061-2070). **(Q12)** Will these "missing years" be included in the new version of the Dashboard?

Overall feedback:

(Q13) Will DCOOP be able to access the Dashboard with updated data after the end of the MED-GOLD project?

(Q14) Why does Dashboard provide data values in the Long Term Projections, while this not the case in the Seasonal Forecasts?

7. CASAS-PBDM FOR OLIVE AND OLIVE FLY

CASAS Global (Center for the Analysis of Sustainable Agricultural Systems, (http://www.casasglobal.org/) physiologically based demographic models (CASAS-PBDMs) [RD.4] are one of the key existing technology components of the MED-GOLD project. The CASAS-PBDMs API is already part of the MED-GOLD ICT platform (https://platform.med-gold.eu/) as the pbdm workflow.

The PBDM used in WP2 explicitly captures the weather-driven biology of the interaction between olive and the olive fruit fly *Bactroceraoleae* [RD.5]. The PBDM for olive and olive fly predicts the geographical distribution and relative abundance of the two species across time and space, independently of the actual species distributions, using extant and climate change weather scenarios as drivers for the system (see [RD.6], [RD.7]).

The added value of PBDMs generally accrues mostly in terms of regional recommendations for crop management as opposed to precise prediction at field level (e.g., the Olivia platform, see section 4 in this document). This is because PBDMs provide an assessment of the olive/olive fly systems at the regional level that is independent of space and time, and hence provides insight on how to best allocate limited resources for agroecosystem management. This kind of insight would be impossible logistically and economically to obtain otherwise (e.g. [RD.8]).

7.1 Feedback after the focus group meeting of May 2019

The CASAS-PBDM for olive and olive fly [RD.5] was not included in the testing phase with the industrial user DCOOP. The reason is that negative feedback from the user required reorganization and shift of focus towards policymakers, while other approaches such as an interactive graphical user interface (e.g., the dashboard) providing access to customized ECVs and climate indices, were prioritized.

Specifically, as already reported in Deliverable 2.6 [RD.9], main remarks noted during the focus group held on 9 May 2019 at DCOOP's premises in Antequera, Spain, include:

1. the information about olive fly is useful only 15 days in advance, when the farmers have to prepare the appropriate insecticide treatment, and hence the presented predictions for months or years in advance are not useful;

2. the information about olive production at the local level is more useful than the production per tree;

3. heavy rainfall events can affect soil water availability and it would be really useful if calculations about the proportion of water that the soil can absorb were available to the agronomists (field technicians).

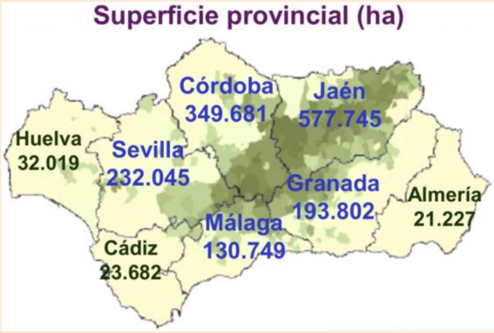
Hence, the industrial user DCOOP showed very little interest in the strategic kind of information and related added-value resulting from PBDMs that mostly accrues in terms of improved management strategy. According to DCOOP, olive farmers would not be interested in improving their management strategy, at least in terms of olive fly management. However, the user did show some interest in obtaining information about olive production at a local level rather than as per tree. Heavy rainfall is not something that the PBDM can currently help with. This and other feedback reported below provided a basis for further work and testing on the PBDM for olive and olive fly.

The feedback provided by DCOOP about PBDMs during the focus group in May 2019 was further explored as part of a continuous feedback loop with DCOOP in the form of a list of questions (i.e., Annex E of Deliverable 2.6 [RD.2], see section 3.1in this document) that the industrial user replied carefully. Section 3.2 is a summary of the issues from Annex E of Deliverable 2.6 [RD.2] (using the same numbering) that are relevant to PBDMs, including the related questions that were asked to DCOOP, the linked replies by DCOOP, and how the PBDM work in the project has addressed those issues.

7.2 Focusing on olive growing area and Andalusia provinces

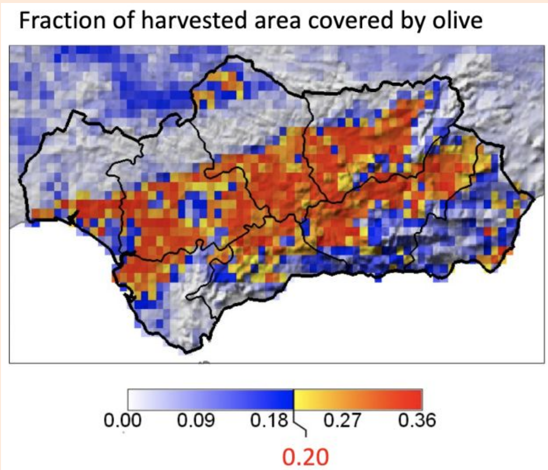
Question 6. During the focus group 2019, the DCOOP participants pointed out that it would be interesting to aggregate climate-related information at the level of more homogeneous olive zones (called *zona olivarera*in Spanish). Participants thought the project should focus on olive areas so as to avoid using information (e.g., climatic) that is not relevant to the olive sector. Further interaction with DCOOP enabled the identification of the *zona olivarera* as the green areas (olive growing area) in the figure below (Fig. A-4 in Deliverable 2.1 [RD.1]).

Figure 7-1: Hectares of olive growing area in each Andalusia province (Source: https://www.juntadeandalucia.es/export/drupaljda/Presentaci%C3%B3n_OLIVAR_2017-2018.pdf)



The project addressed this issue by including a geographic information layer for olive growing area in the GRASS-based ([RD.9]) Geographic Information System (GIS) that is used to map the output of the PBDM for olive and olive fly. Specifically, we used the harvested area covered by olive from Monfreda et al. (2008, [RD.10], seehttp://www.earthstat.org/) (Fig. 7-2).

Figure 7-2: Fraction of harvested area covered by olive in each 10 km x 10 km grid cell in Andalusia (Data from http://www.earthstat.org/)



and was run continuously for the period 1980-2010 using AgMERRA data by Ruane et al. (2015, [RD.15], seehttps://data.giss.nasa.gov/impacts/agmipcf/).

We used the AgMERRA dataset because it includes the six climate variables required to run PBDMs: maximum and minimum temperature, precipitation, solar radiation, relative humidity, and wind. AgMERRA is a climate forcing dataset created as an element of the Agricultural Model Intercomparison and Improvement Project (AgMIP, https://agmip.org/) to provide consistent, daily time series over the 1980-2010 period with global coverage of the climate variables required for agricultural models [RD.15].

Most of the climate data processed and used in the project (observations, forecasts, and projections) only include temperature and precipitation [RD.16] [RD.17]. However, models that simulate biological processes in crop systems, require a larger set of variables that AgMERRA exemplifies as an international standard for agricultural models, and include solar radiation, relative humidity, and wind. How the biological component, which is itself a system (i.e., a food web), interacts with the climate system and how to assess this interaction is an open scientific question that the last two Assessment Reports of the Intergovernmental Panel on Climate Change (IPCC) pointed out clearly [RD.18] [RD.19].

AgMERRA was used to run a baseline present-climate assessment of the olive-olive fly system in Andalusia. However, the initial plan was to use AgERA5 [RD.16], a dataset developed by the Copernicus Climate Change Service (C3S) that is similar to AgMERRA, with a similar set of standard climate variables for agricultural modeling at higher spatial resolution, and is based on the more recent reanalysis ERA5 [RD.17]. In late 2019, the project was given early access to AgERA5 by C3S (thanks to C3S Director Dr. Carlo Buontempo, who is a member of the project's External AThis resulted in the GIS mapping PBDM output only for Andalusian locations (i.e., grid cells of resolution about 10 km x 10 km, the native resolution of the geographic layer for olive growing area [RD.10]) where the fraction of the agricultural area covered by olive is greater than 0.20 (see Figs 7-3, 7-4). It was agreed with DCOOP to use a threshold of 0.20 (20%) so as to focus on the areas where olive is most intensively grown in Andalusia. The PBDM simulation has a daily time step dvisory Committee, EAC). The MED-GOLD project was then able to test AgERA5 and provided feedback via the C3S User Support Service that was useful to fix some problems before the dataset was eventually made publicly available on the C3S Climate Data Store (CDS, https://cds.climate.copernicus.eu/cdsapp#!/home) in early February 2020 [RD.16].

The standard climate scenarios produced in MED-GOLD do not include the full set of climate variables required to run PBDMs [RD.17] (e.g., solar radiation required for running the olive plant model is missing). As a consequence, an additional and slower climate data processing chain was implemented for PBDMs. The climate change scenario data complete with the six required variables were available in early January 2020.

Seasonal climate forecast data available under the project also miss the full set of climate variables required to run PBDMs [RD.17]. Further, seasonal climate forecasts have not been previously used to run PBDMs, and hence this is an open and nontrivial research question that will be addressed as such. For example, seasonal forecast data are generally provided and used on a monthly time scale, including in MED-GOLD, but PBDMs require daily climate data as input. This and other issues are being discussed at project level: for example, important side discussions on this topic took place during the last general assembly (GA) in Cagliari (October 2019). Hence, the seasonal time scale for PBDMs will be pursued on a research level rather than in a prototype climate service context, as a general approach.

The PBDM computes many aspects of the daily age-structured dynamics of olive and olive fly, such as Julian bloom dates, season yield, cumulative season-long olive fly pupae, and the percent of fruit attacked that can be used as metrics of agroecosystem performance (Gutierrez et al. 2009; [RD.5]). Here, olive yield and the relative density of olive fly are used as an example, while greater detail will be provided in Deliverable 2.2 [RD.18]

In addition to maps for olive yield (g dry matter per tree) and for relative density of olive fly (cumulative number olive fly pupae per season per tree) (Fig. 3-3), the PBDM/GIS tool can also output the same variables as histograms illustrating the frequency distribution for PBDM grid cell values (Fig. 7-4).

Figure 7-3: Average olive yield (g dry matter per tree) with the corresponding standard deviation (top), and relative season-long abundance of olive fly (cumulative number olive fly pupae per season per tree) with the corresponding standard deviation (bottom) simulated by the PBDM in Andalusia for the period 1981-2010 using AgMERRA data. Note that mapping of PBDM output is restricted to areas where olive is grown more intensely (i.e., areas with a fraction of agricultural area devoted to olive greater than 0.20).

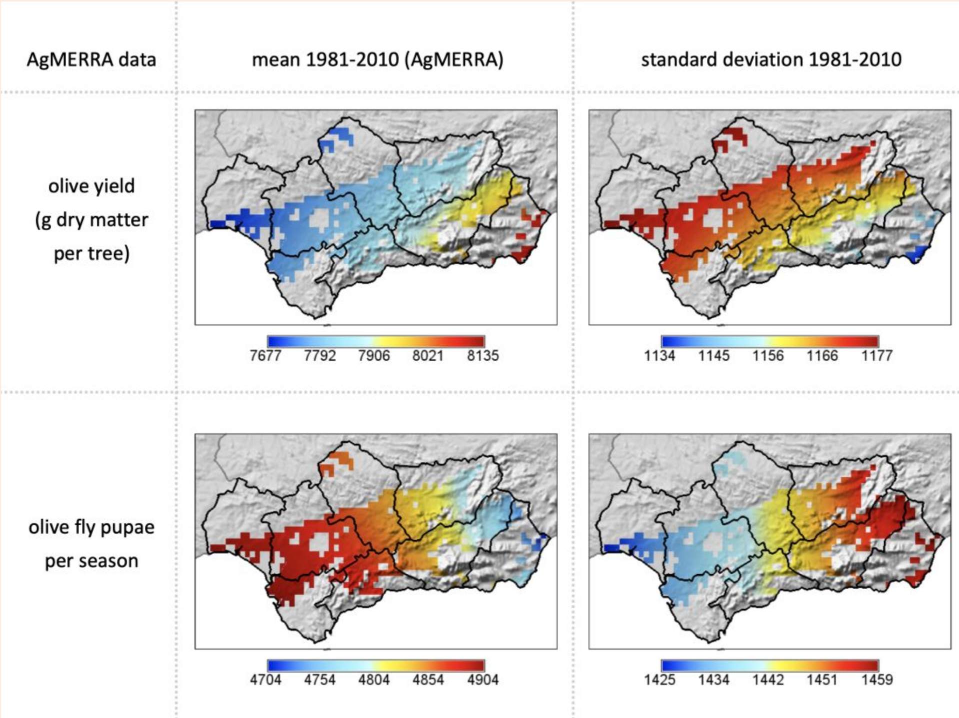
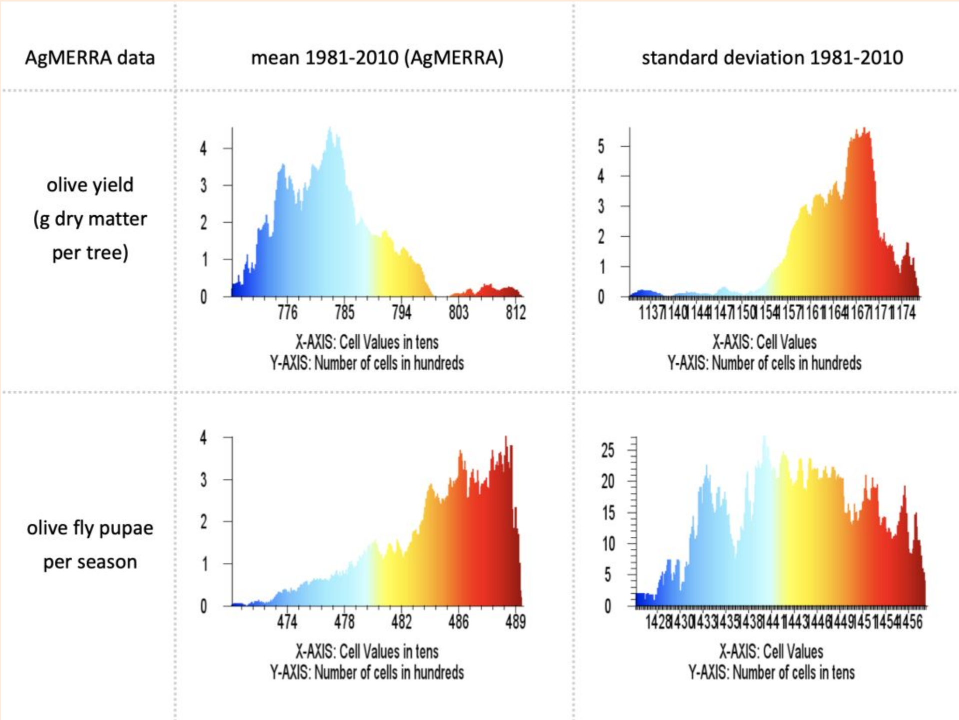
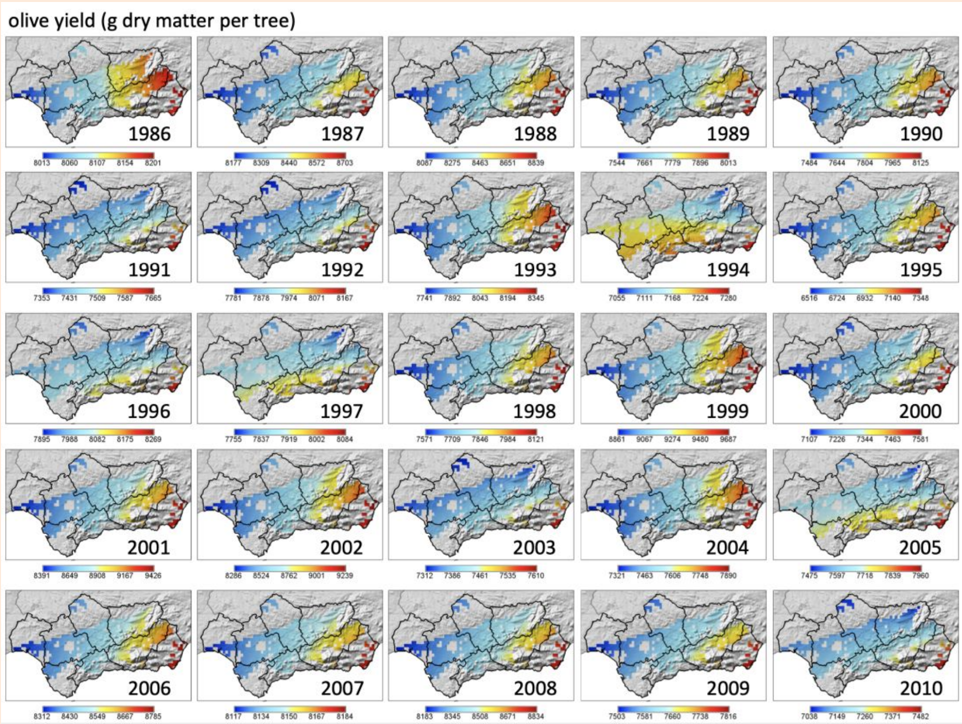


Figure 7-4: Frequency histograms for maps in Fig. 3-3: average olive yield (g dry matter per tree) and standard deviation (top), and relative season-long abundance of olive fly (cumulative number olive fly pupae per season per tree) and standard deviation (bottom) simulated by the PBDM for the period 1981-2010 using AgMERRA data.



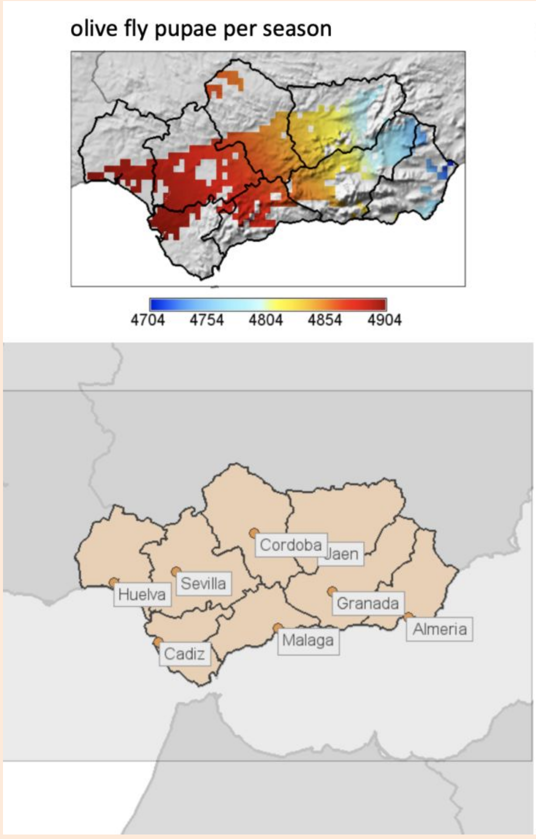
All the aspects of the daily age-structured dynamics of olive and olive fly computed by the PBDM and mapped as average in Figure 7-3, can be mapped by year as shown in Figure 7-5 for olive yield.

Figure 7-5: Yearly maps of olive yield (g dry matter per tree) simulated by the PBDM in Andalusia for the period 1986-2010 using AgMERRA data. Note that mapping of PBDM output is restricted to areas where olive is grown more intensely (i.e., areas with a fraction of agricultural area devoted to olive greater than 0.20).



In response to DCOOP request to aggregate information at the level of areas in the different provinces of Andalusia where olive is grown more intensely (i.e., areas with a fraction of agricultural area devoted to olive greater than 0.20), the PBDM/GIS was provided with the ability to report raster statistics for output maps of olive and olive fly variables in each province and only for areas where olive is intensely grown in each province. An example of this functionality is provided in Figure 7-6.

Figure 7-6: Statistics for PBDM output limited to olive Fraction of harvested area covered by olive in each 10 km x 10 km grid cell (Data from http://www.earthstat.org/)



raster statistics by province

```
+-----------------------------------------------------------------------------+
|                         RASTER MAP CATEGORY REPORT                          |
|LOCATION: laea_andalusia                                                     |
|-----------------------------------------------------------------------------|
|          north:  153000    east:  287000                                    |
|REGION    south: -170000    west: -255000                                    |
|          res:      1000    res:      1000                                   |
|-----------------------------------------------------------------------------|
|MASK: none                                                                   |
|-----------------------------------------------------------------------------|
|MAPS: Rasterized vector map from labels (andalusia_provinces in medgold)     |
|                                                                             |
|-----------------------------------------------------------------------------|
|                    Category Information                |  square  | cell|  % |
|   #|description                                       |kilometers|count|cover|
|-----------------------------------------------------------------------------|
|1290|ES-CA (Cádiz)                                      |  2250.000| 2250| 5.95|
|    |--------------------------------------------------|----------|-----|-----|
|    | 4853.736426-4903.81187|from  to . . . . . . . . .|  2250.000| 2250|100.00|
|-----------------------------------------------------------------------------|
|1688|ES-H (Huelva)                                      |  1905.000| 1905| 5.04|
|    |--------------------------------------------------|----------|-----|-----|
|    | 4853.736426-4903.81187|from  to . . . . . . . . .|  1905.000| 1905|100.00|
|-----------------------------------------------------------------------------|
|2503|ES-AL (Almería)                                    |  1534.000| 1534| 4.06|
|    |--------------------------------------------------|----------|-----|-----|
|    |4703.510094-4753.585538|from  to . . . . . . . . .|   886.000|  886|57.76|
|    |4753.585538-4803.660982|from  to . . . . . . . . .|   614.000|  614|40.03|
|    |4803.660982-4853.736426|from  to . . . . . . . . .|    34.000|   34| 2.22|
|-----------------------------------------------------------------------------|
|2504|ES-GR (Granada)                                    |  7696.000| 7696|20.35|
|    |--------------------------------------------------|----------|-----|-----|
|    |4703.510094-4753.585538|from  to . . . . . . . . .|   338.000|  338| 4.39|
|    |4753.585538-4803.660982|from  to . . . . . . . . .|  2895.000| 2895|37.62|
|    |4803.660982-4853.736426|from  to . . . . . . . . .|  4184.000| 4184|54.37|
|    | 4853.736426-4903.81187|from  to . . . . . . . . .|   279.000|  279| 3.63|
|-----------------------------------------------------------------------------|
|2505|ES-MA (Málaga)                                     |  3298.000| 3298| 8.72|
|    |--------------------------------------------------|----------|-----|-----|
|    | 4853.736426-4903.81187|from  to . . . . . . . . .|  3298.000| 3298|100.00|
|-----------------------------------------------------------------------------|
|2506|ES-SE (Sevilla)                                    |  7921.000| 7921|20.94|
|    |--------------------------------------------------|----------|-----|-----|
|    | 4853.736426-4903.81187|from  to . . . . . . . . .|  7921.000| 7921|100.00|
|-----------------------------------------------------------------------------|
|4539|ES-CO (Córdoba)                                    |  6199.000| 6199|16.39|
|    |--------------------------------------------------|----------|-----|-----|
|    |4803.660982-4853.736426|from  to . . . . . . . . .|  2860.000| 2860|46.14|
|    | 4853.736426-4903.81187|from  to . . . . . . . . .|  3339.000| 3339|53.86|
|-----------------------------------------------------------------------------|
|4541|ES-J (Jaén)                                        |  7022.000| 7022|18.56|
|    |--------------------------------------------------|----------|-----|-----|
|    |4753.585538-4803.660982|from  to . . . . . . . . .|  2140.000| 2140|30.48|
|    |4803.660982-4853.736426|from  to . . . . . . . . .|  4882.000| 4882|69.52|
|-----------------------------------------------------------------------------|
|TOTAL                                                  |37,825.000|37825|100.00|
+-----------------------------------------------------------------------------+
```

In the context of the continuous feedback loop activated using the list of questions in Annex E of Deliverable 2.6 [RD.1] (see specific section 3.1.1in this document), DCOOP suggested that a more recent and detailed geographic information layer for olive growing area would be used, and suggested that the Web GIS for the Identification of Agricultural Plots developed by Junta de Andalucía (the Government of Andalusia) (SIGPAC [RD.19]) would a good source of information for that.

SIGPAC was created through collaboration between the Spanish Agricultural Guarantee Fund (FEGA) and the various Autonomous Communities of Spain, as an element of the Integrated Management and Control System for direct aid schemes of the EU Common Agricultural Policy. For this reason, SIGPAC also provides detailed and up-to-date land use data, including an “Olivar” (olive grove) land use class, that are freely available to users for download subject to proper citation and attribution of authorship to Junta de Andalucía.

A raster map of pure olive groves in Andalusia was generated from the SIGPAC 2018 vector dataset by applying a filter using a SQL query. This SIGPAC-based olive growing area layer will replace the harvested area covered by olive from Monfreda et al. (2008, [RD.10] in future PBDM/GIS runs.

7.3 Linking to policy making in Andalusia and Europe

Question 9. During the focus group 2019, the DCOOP participants commented further on the potential of the PBDM for olive and olive fly to provide recommendations for crop management. As already mentioned, participants stated that they did not see any result in terms of the olive tree production and its relationship with the olive fly that could be interesting for DCOOP. Another point was that olive fly infestation levels at regional scale could be of interest to Governments/Ministers for allowing and planning the phytosanitary treatments, as insecticide treatments are more effective if all the farmers of a specific area treat at the same time. Question 9 in the continuous feedback questionnaire (see Annex E of Deliverable 2.6 inquired further about local authorities that would appear to be involved in both authorizing and planning phytosanitary treatments and may be interested in olive fly infestation risk as regional level. DCOOP responded that local authorities in Andalusia regule the procedure for authorizing phytosanitary treatments and can perform inspections at farm level to ensure that farmers and technicians acted in compliance with relevant law. Field technicians may recommend (farm size < 5 ha) or prescribe (farm size > 5 ha) phytosanitary treatments, while farmers are in charge of pest monitoring, treatment application, and keeping official records.

Overall, the feedback provided by DCOOP using the questionnaire confirmed that information associated with the PBDM for olive and olive fly would not be useful to olive farmers, particularly because the time scale is far beyond the 1-2 weeks maximum time horizon within which olive fly management decisions currently are made. However, it is DCOOP's opinion that information on the areas expected to be under the risk of olive fly attack on a regional scale could be useful to other types of climate service users, particularly Governments/Ministers. This is why PBDM activities in the project have been reorganization with shift of focus towards policymakers, while other approaches such as the MED-GOLD dashboard were prioritized to reflect the key request made by DCOOP of having an interactive climate service tool (see Question 7 where DCOOP indicated major design and graphical layout specifications for the dashboard that were fed into the specification document for the dashboard).

8. Conclusions

The feedback for this report was obtained through an online survey for the evaluation of the Olivia platform and a virtual demonstration for the evaluation of the Dashboard tool, which both took place in May 2020. Also, through a meeting carried out by the Dashboard team from MED-GOLD in April 2020.

Overall, the average rating for the Olivia platform is 3.3 / 5. The maps and information provided by the application are easy to understand and interpret; just more descriptive figure legends would be helpful. Moreover, the navigation through the platform was generally defined as easy and fast; just few accessibility issues were reported. An improvement regarding the location of the farms is needed, since the farms shown on the map do not correspond to the real ones. The end-users reported some difficulties in locating specific farms on the map and suggested that the farms' identification should be more flexible and that more regions could be included. However, they liked the visualisation of the farms' data. An important asset of the application that was highlighted is that it helps in decision making about the pest treatment and the sustainable use of the phytosanitary products. The short-term forecast (3-5 days) is very useful. An issue raised by the end-users was the validity of the forecasts; they would like to have more accurate forecasts. It was proposed that the tool would be even more useful if more pests apart from the olive fly were included. Almost half of the end-users reported that the application helped them in making the treatment plans and choosing the best date for making the treatment orders and almost all of them agreed that they wish to use the tool if it becomes available in the future, but most of them wouldn't pay for it. It was suggested that the platform could warn the users by SMS or whatsapp messages and also that it could provide more agronomic parameters.

The results from the Dashboard's evaluation could be summarised to the following conclusions. It should be noted that the evaluation was made using indices other than the ones selected as appropriate for the olive sector. Thus the main concern of the end-users was if the indices for the olives will be available in the final version of the tool and if the tool will be accessible after the end of the MED-GOLD project. They also suggested the inclusion of three new indices: i) the total precipitation from September to October (which is already available, but only for the Douro area in Portugal), ii) the number of hot days from September to October and iii) the number of hot summer days (T>40º C)

- The file formats of the exported data (GeoJSON and NetCDF) are not user-friendly, the excel format is preferred.

- The produced maps should be updated with better graphics, colourbars and legends.

- It was suggested that the application could provide the option to create a report when the graphics are generated. The report could automatically collect all the information of the steps followed by the users to get the final graph.

- The tool could provide more explanatory texts (e.g. indices description, which are the data sources, what is ERA5)

- The seasonal forecasts, although very useful, are not so clear and comprehensible to the end-users.

- The long-term projections are not useful for key decisions.

Annex A. Working materials

Figure A-1. The olive/olive oil sector flyer for the evaluation of the Olivia platform.

Turning climate-related information into added value for traditional MEDiterranean Grape, OLive and Durum wheat food systems

MED-GOLD

THE MED-GOLD PROJECT

MED-GOLD is a four-year research and innovation project. The aim of MED-GOLD is to **develop climate services specific to agriculture**, a sector directly impacted by climate variability and change. In particular, MED-GOLD will develop climate services for **Olive/Olive Oil sector,** to **demonstrate the applicability and benefits** of such services within key decision-making processes, **minimize climate-driven risks and seize opportunities** for this sector.

THE OLIVIA PLATFORM

The Olivia platform is part of the climate service being developed for the olive/olive oil sector in Med-Gold and can help support decisions about olive grove by anticipating and improving information related to:

- Productivity – It predicts the production of olive, oil and fat yield, optimizing fertigation;
- Pest control - It anticipates up to 4 weeks the evolution of pest to level plot;
- Market forecast - Models the production of global market and olive producing regions.

More on the OLIVIA platform here: https://www.olivia.ec2ce.com/

WE NEED YOUR HELP!

As you have used and tested the Olivia platform in the past, we would like to ask you to fill in a short survey with regards to how you used the platform, the type of information you used, how useful it was, etc. This information will help us understand how useful and practical the OLIVIA platform is in supporting the type of decisions you need to make with regard to olive production.

The survey can be accessed using the link provided below until **13th May 2020**.

YOUR CONTRIBUTION

Your data will kept anonymous and access to this data will be restricted to the project team. The results may be published in academic journals, presented at scientific conferences and project reports will be freely available from the Med-Gold project website.

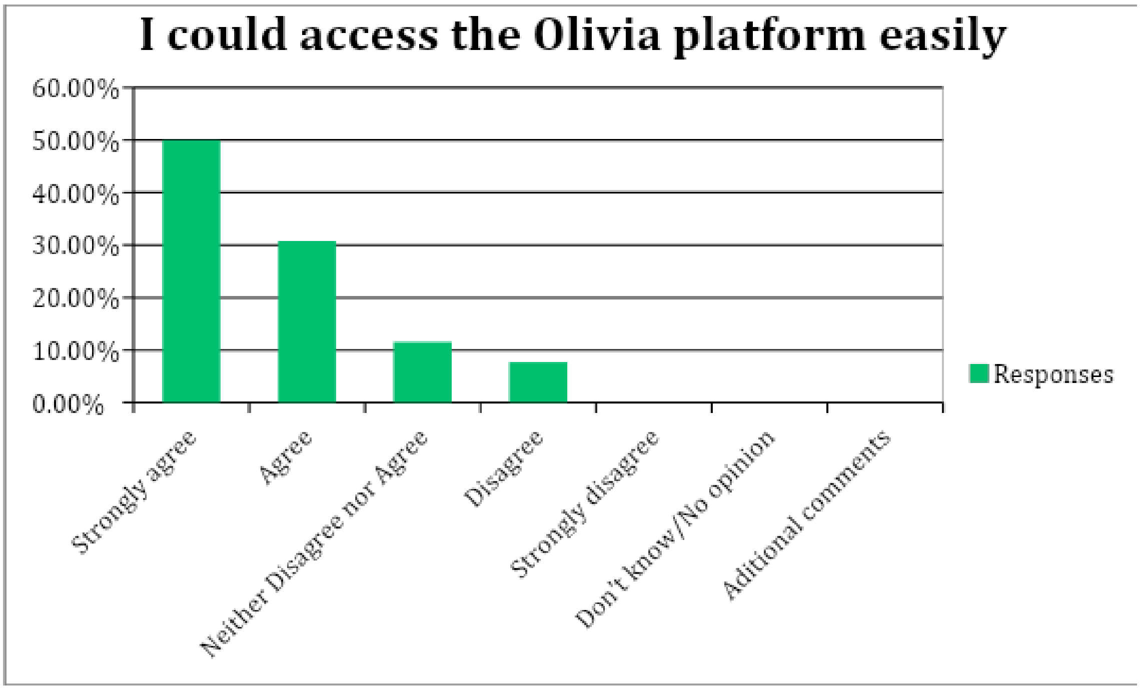
The survey can be found: **https://www.surveymonkey.co.uk/r/oliviaplatform**

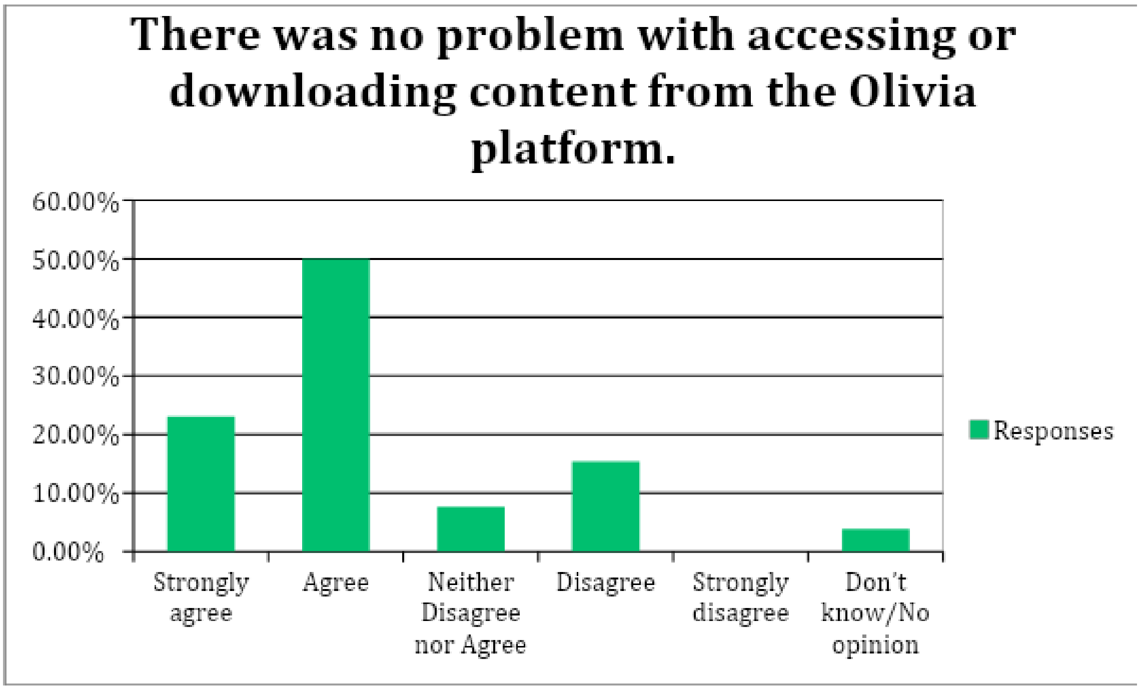
More information on the **MED-GOLD project** can be found here: www.med-gold.eu/

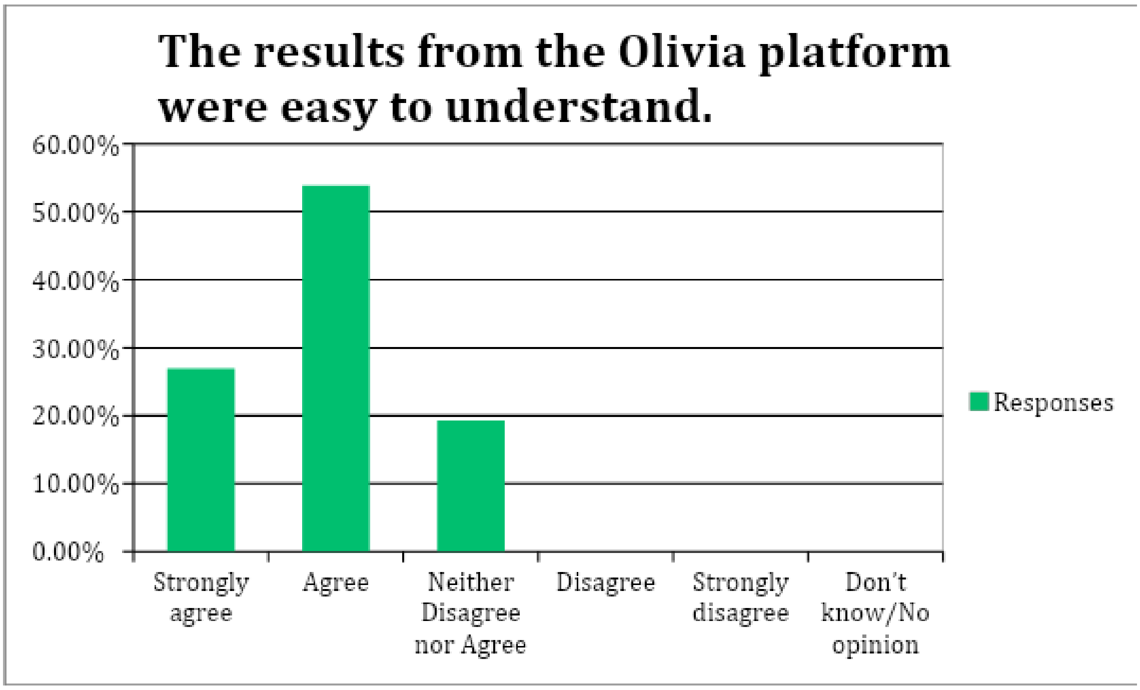
This project has received funding from the European Union's **Horizon 2020 research and innovation programme** under grant agreement no. 776467

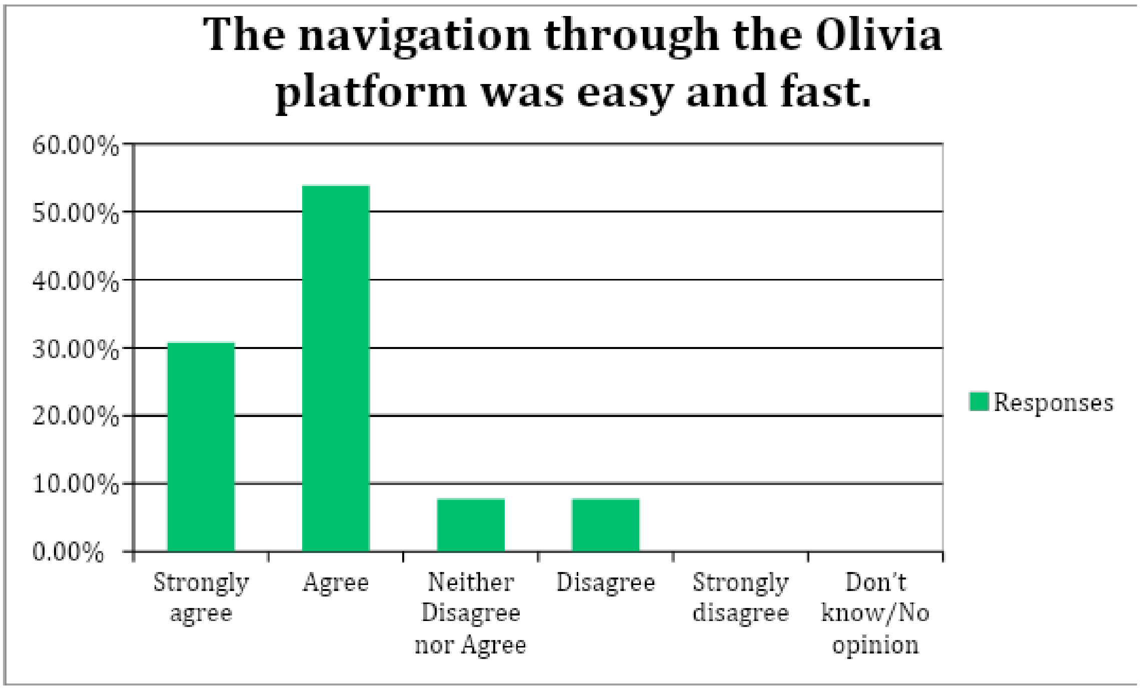
Annex B. Answer graphs from Olivia's evaluation

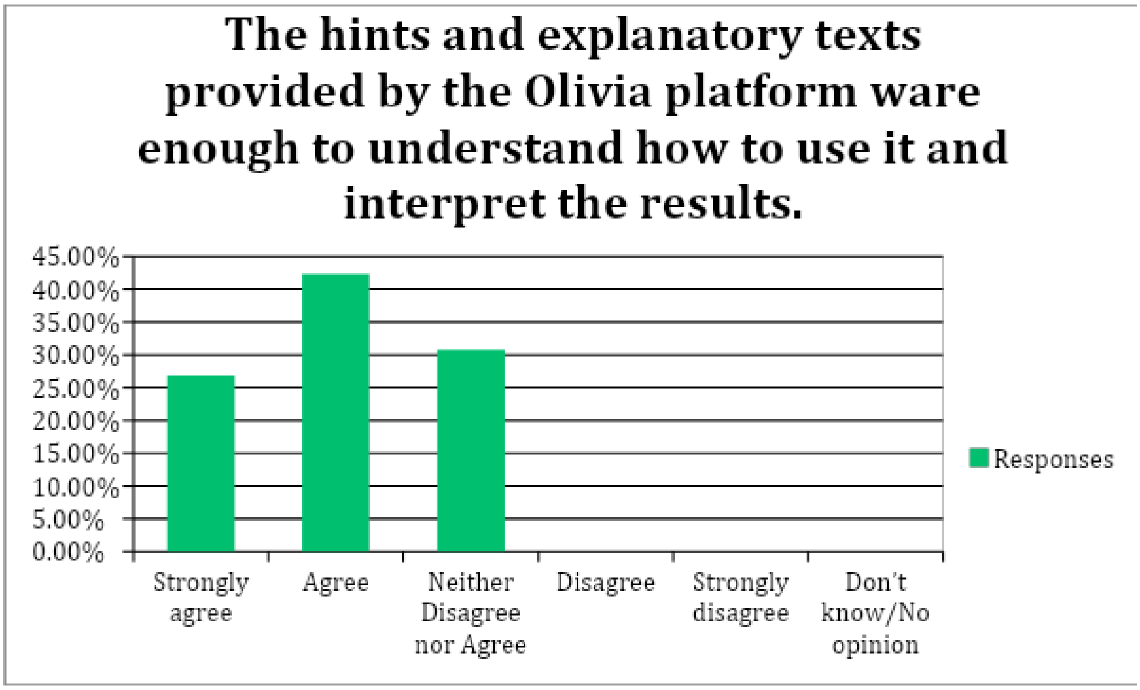
Figure B-1. The statistics graphs as resulted from the evaluation of the Olivia platform.



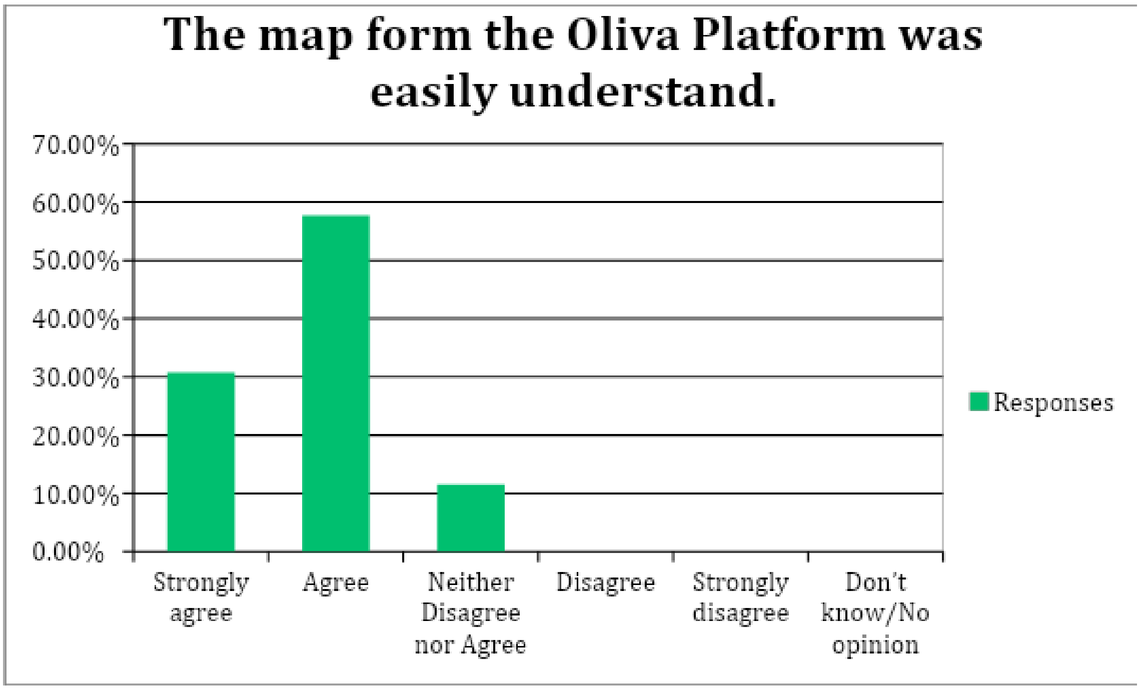

There was no problem with accessing or downloading content from the Olivia platform.
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Strongly agree
Agree
Neither Disagree nor Agree
Disagree
Strongly disagree
Don't know/No opinion
Responses

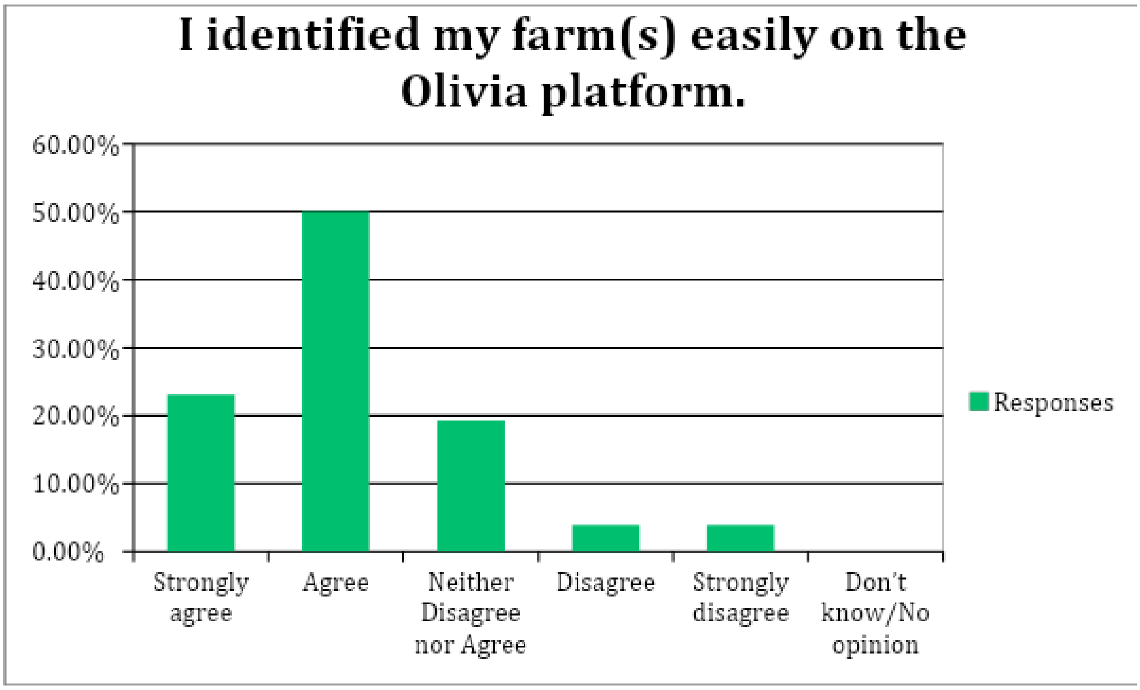

The results from the Olivia platform were easy to understand.
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Strongly agree
Agree
Neither Disagree nor Agree
Disagree
Strongly disagree
Don't know/No opinion
Responses

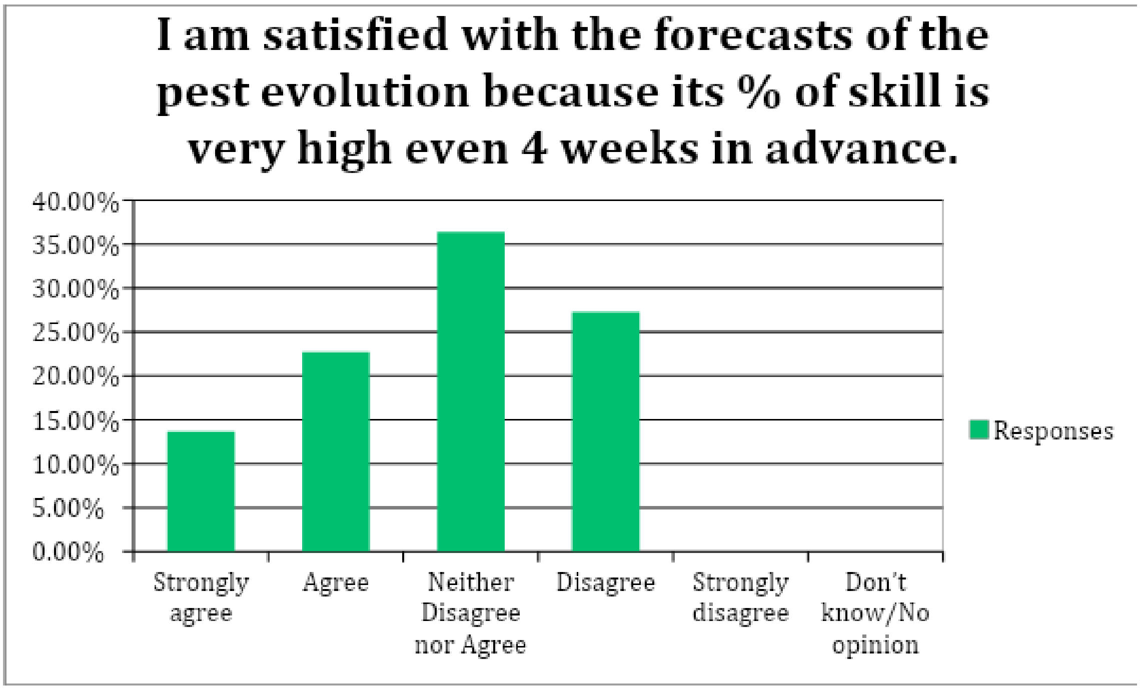


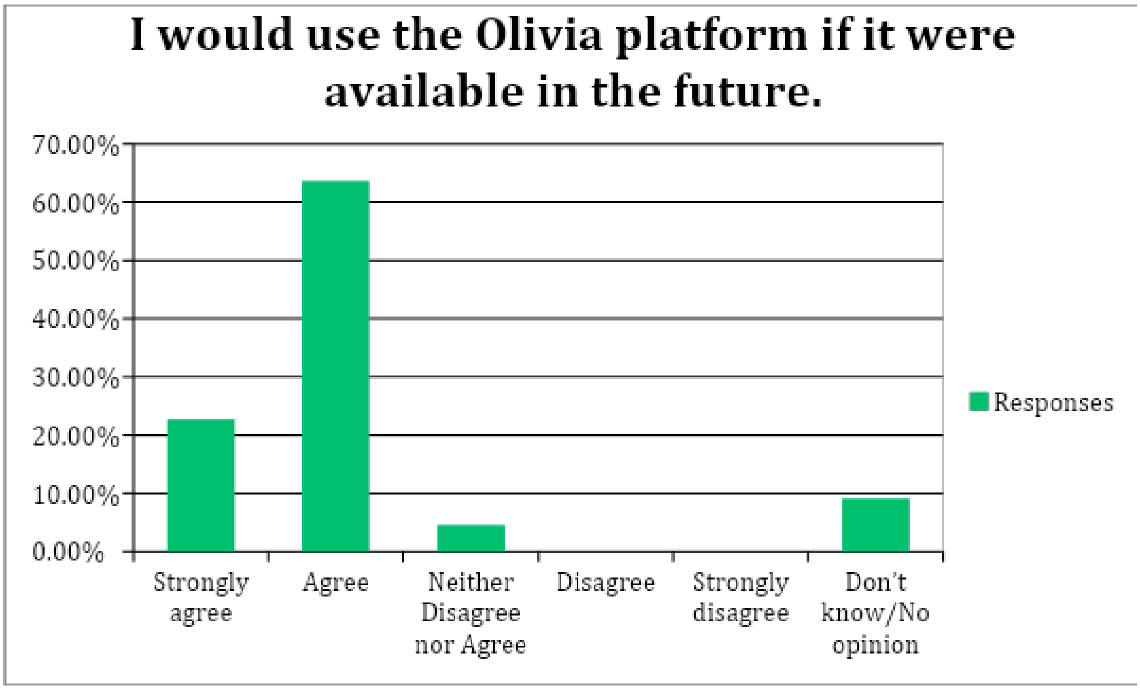


The hints and the explanatory texts provided by the Olivia platform were enough to understand how to use the platform and to interpret the results


The map form the Oliva Platform was easily understand.
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Strongly agree
Agree
Neither Disagree nor Agree
Disagree
Strongly disagree
Don't know/No opinion
Responses


I identified my farm(s) easily on the Olivia platform.
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Strongly agree
Agree
Neither Disagree nor Agree
Disagree
Strongly disagree
Don't know/No opinion
Responses


I am satisfied with the forecasts of the pest evolution because its % of skill is very high even 4 weeks in advance.
40.00%
35.00%
30.00%
25.00%
20.00%
15.00%
10.00%
5.00%
0.00%
Strongly agree
Agree
Neither Disagree nor Agree
Disagree
Strongly disagree
Don't know/No opinion
Responses


I would use the Olivia platform if it were available in the future.
70.00%
60.00%
50.00%
40.00%
30.00%
20.00%
10.00%
0.00%
Strongly agree
Agree
Neither Disagree nor Agree
Disagree
Strongly disagree
Don't know/No opinion
Responses

END OF DOCUMENT