

IPM Decisions

D3.3 DSS Use Dashboard for farmers and advisors

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Public Summary

IPM Decisions has produced the first full-functional version of the IPM Decisions Platform and Decisions Support Systems Use Dashboard complete with services that automate the retrieval of weather data and running of DSS on a daily basis.

Executive Summary

According to D3.3 description (EU project portal): “The source code for web-based dashboard for farmers and advisors will have been written, following the specification developed in D3.1. The source code for the web services supporting the dashboard will have been written (D3.11, D3.13). The text for the dashboards and its accompanying help system will have been written. The dashboard will have been tested to ensure that it is working correctly before being published on the project web platform for farmers and advisors to use.”

This deliverable D3.3 “DSS User Dashboard” intends to give an overall view about the activities carried on to have the first DSS dashboard ready to be used by IPM DECISIONS stakeholders.

Indeed, it briefly describes the methodology used to collect the feedback by stakeholders on IPM platform’s mockups making reference to Deliverable 6.4 (where user requirements specifications are incorporated), then focuses on the definition of the development planning and the description of Farm Management (which can be used to manage the farms), DSS selection (which can be used to select a DSS to monitor the crops on specific pests) and DSS Use dashboard (which allows farmers and advisors to see the risk level associated to each farm’s crop for specific pests) screenshots. Finally, it includes a verification plan used to ensure that IPM DECISION’s dashboards are successfully integrated and perform as they were described during the design phase of the project.

This deliverable takes into account findings from D3.1 “Defined layouts and specifications for the three Dashboards aimed at farmers, advisors and interest groups” (M9) and D3.10 “A web-based portal for the platform with user authentication” (M12), and represents a starting point for D3.4 “DSS Comparison Dashboard for farmers, advisors and interest groups” (M30) and D3.5 “DSS Adaptation Dashboard for farmers, advisors and interest groups” (M36).



Acronyms

API	Application Programming Interface
CSS	Cascading Style Sheets
DMP	Data Management Plan
DoA	Description of Activities
DSS	Decision Support System (singular or plural)
EPPO	European and Mediterranean Plant Protection Organization
GA	Grant Agreement
IPM	Integrated Pest Management
ISTQB	International Software Testing Qualifications Board
SUD	Sustainable Use Directive
US	User stories
WP	Work package

Glossary of terms

Dashboard	The interface seen by the user to access the underlying functionality of the platform
Pest	The word pest will be used as a generic term to mean pest, disease and/or weed within the context of this document

List of Authors

Partner name	Partner member
ENG	Francesca Cantore
ENG	Antonio Caruso
ADAS	Dave Skirvin
ADAS	Antonio Calatayud

List of Reviewers

Partner name	Partner member
RSK Environment	Neil Paveley
RSK Environment	Mark Ramsden



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1 Introduction

1.1 Context and scope of the deliverable

D3.3 deliverable reports the methodology for collecting the stakeholders' feedback on IPM platform's mockups and to describe carefully all the details related to the IPM Portal features implementation of:

- The **Farm Management** which manages the farm entity with its crops and the pests associated with the crop;
- The **DSS Selection** which enables the selection of the specific DSS to associate to a crop – pest combination;
- The **DSS Use Dashboard** which allows farmers and advisors to see the risk level associated to each farm's crop for specific pests;

The design and the implementation of these functionalities will have an impact on the following dashboards that will be developed respectively in D3.4 and D3.5:

- **DSS Evaluation Dashboard** that will allow users to compare different DSS tools and their outputs (Primary users: advisors and researchers);
- **DSS Adaptation Dashboard** that will enable modification of the parameters within a DSS to facilitate adaptation of the DSS to specific countries (Primary users: developers and researchers).

1.2 Relationship with other tasks

Sub task 3.1.2. "Development of Dashboards" is strongly influenced by WP2 "Integration and sharing of data, models and tools" for input and output data definition and by Sub task 3.1.1. "Design of Dashboards" which covered all the user requirements activities. The sub task 3.1.1 takes into account inputs coming from (1) the description of the dashboards contained in DoA; (2) stakeholders feedback collected during the workshops (Task 6.1.2); (3) DMP for the dataset identification; (4) DSS Catalogue from which it is possible to identify the features of the available DSS (Task 4.2).

Subtask 3.1.2 is also influenced by T3.3 (Development of platform) in terms of graphic layout of the pages, data modelling to be shown in the dashboards, technological reference, web objects such as widgets, graphs, input and output structures.



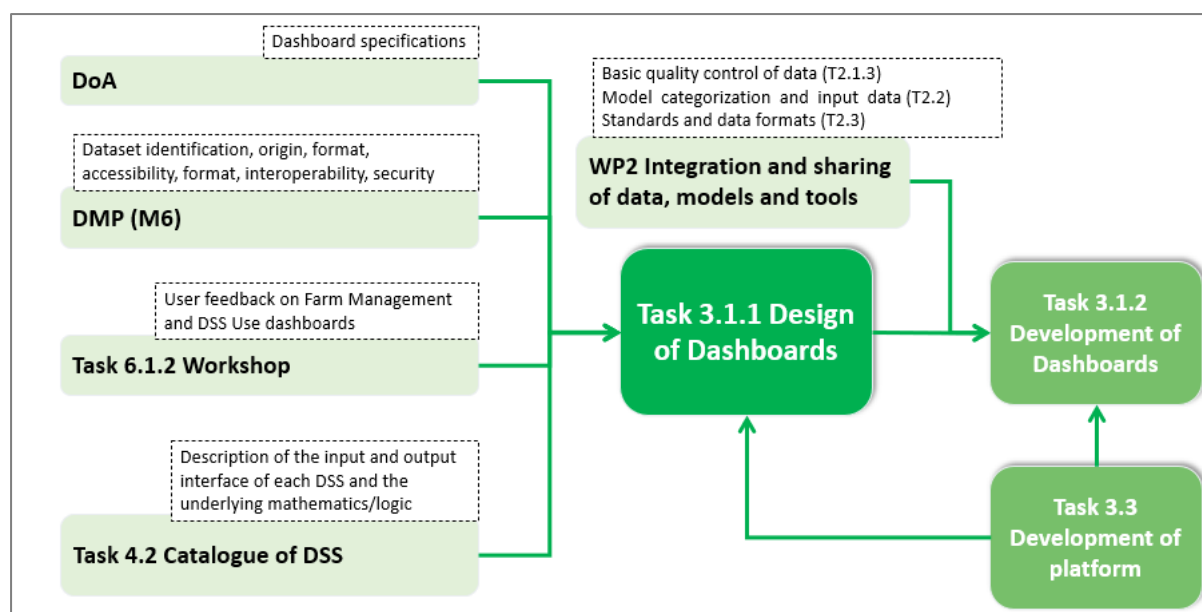


Figure 1: Relationship with other tasks

2 Methodology

A key principle of the IPM Decisions concept is to apply a user-centered design approach which requires the involvement of end-users (farmers, advisors, researchers) and relevant stakeholders in the design of the dashboard. In order to ensure the dashboards will be best utilised by users it is important to carry on the design process by identifying and incorporating the needs and preferences of key user groups.

The methodology followed to produce specifications and mockups for IPM dashboards was focused mainly on listening to platform end users. This was focused on:

- Collecting user stories through the first round of workshops;
- Collecting feedback on DSS dashboard mock-ups through the second round of workshop.

During the first year, a form for each user category was defined in order to collect “**stories**” directly from stakeholders. Results collected by means of these forms were used together with **DoA** inputs (which consider project’s objectives and challenges) to provide a list of requirements to take into account for the mock-ups design and then for the dashboard implementation. All the details are included in D3.1.

Moreover, in the second year, **workshops** were organized to show, through mock-ups, different options of the dashboards based on the input collected via the user stories. The scope was to collect feedback from stakeholders on the dashboard design in order to implement the most preferred option. The results from the workshops (described in Deliverable 6.4) have been used to produce the current suite of features in the Platform and DSS Use Dashboard, and further updates to the Platform and Dashboard will be made to reflect the results from the workshops as far as possible. The key updates planned are focused on creating shortcuts for setting up farms and also to include the detailed output as a set of figures and tables with action text, as these were features that the majority of stakeholders wished to see. Furthermore, the results of the workshops influenced the current interface design; all details will be considered in future versions of the dashboard and platform.



3 Development

This section provides details about the IPM Portal main features implemented to date: Farm Management, DSS Selection and the DSS Use Dashboard.

Please note that in the following screenshots, the attributes Crop and Pest have, as values, the EPPO codes included in the EPPO Global Database¹. Work is currently in progress to develop an appropriate mapping of these EPPO codes to the latin and common names of the crop or pest, utilizing the EPPO database API to identify the common names in different languages (where a common name is not available then the latin name will be used by default).

3.1 Development Planning

The DSS Use Dashboard will support farmers and advisors in identifying the risk status on crops based on a specific crop/pest combination, with the interface providing both simple and more detailed outputs to aid users in making a decision. Designing improvements foreseen in the IPM Decisions project, means finding a suitable alignment between the capabilities provided by the platform and the data types returned by the specific DSSs envisaged for its experimentation. The defined output object expected by the Platform goes some way to ensuring that the approach we use is aligned with the outputs from the DSS, as we know that DSS will always return a specific set of data in a defined format. The initial (Alpha) release of the platform will contain a limited set of DSS (mainly those within the VIPS system²), where the DSS return primarily risk outputs and some numerical additional outputs that can be displayed as either bar or line chart. The intention for the Beta version is to include a wider range of DSS (predominantly those provided by partners within the project), with the ability to also display outputs as tables or text, which requires an update to the DSS Output Object schema developed by WP2. The Final version will then have a large complement of DSS, including DSS provided by project Stakeholders.

3.2 Farm Management

Through the Farm Management, the users (farmer or advisor) is able to manage their farm. They are able to define crops and fields and to assign pest/diseases to the crops. In the following sections, a description of the interfaces used and how they function is provided for:

- Farm List
- Add Farm
- View Farm
- Copy Farm
- Edit Farm
- Delete Farm

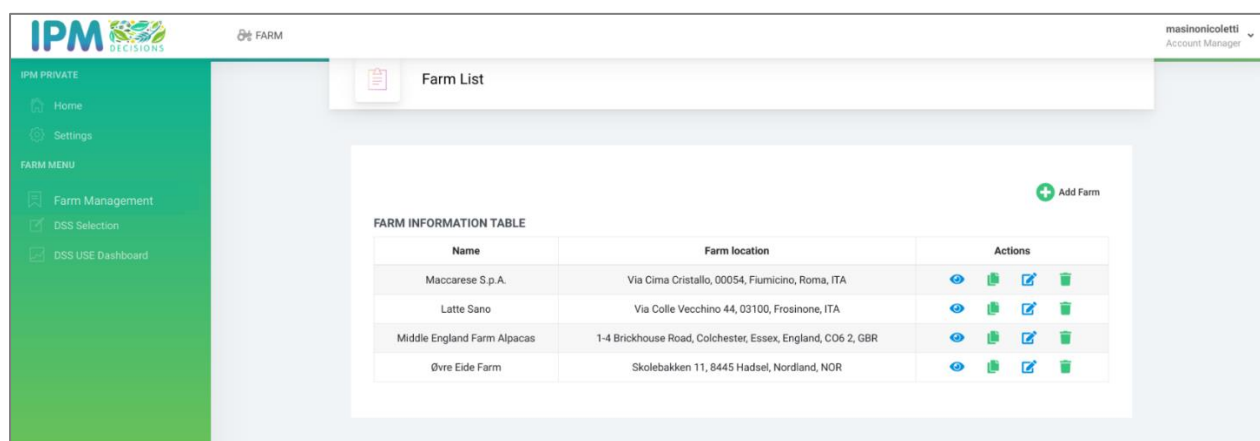
¹ <https://gd.eppo.int/>

² <https://www.nibio.no/en/services/vips>

- Add crop/pest combination
- Edit crop/pest combination
- Delete crop/pest combination
- Add Observation
- Add Spray applications
- Crop Details

3.2.1 Farm list

Through this interface, the user (farmer or advisor) is able to see the list of existing farms with information related to farm name and location. The user is able to view/edit the farm, duplicate the farm and change it, delete the farm. In addition, the user is also able to click to add a farm.



Name	Farm location	Actions
Maccarese S.p.A.	Via Cima Cristallo, 00054, Fiumicino, Roma, ITA	
Latte Sano	Via Colle Vecchino 44, 03100, Frosinone, ITA	
Middle England Farm Alpacas	1-4 Brickhouse Road, Colchester, Essex, England, CO6 2, GBR	
Øvre Eide Farm	Skolebakken 11, 8445 Hadsel, Nordland, NOR	

Figure 2: Farm List

3.2.2 Add farm

Through this interface, the user can register a farm. The user is able to add the farm name, then select on the map the farm location. On selecting a farm location, the nearest weather data station is identified and displayed in the “Nearest met. Station”. The user is then able to select an alternative nearest meteorological station to be used, if desired. Finally, the user has to select the “Weather forecast service” and click on Save in order to add the new farm.



Figure 3 Add Farm

3.2.3 View Farm

Through this web page, a user (farmer or advisor), can visualise all the details related to a farm. To go into the farm detail, the user can click on the “eye” icon in the farm list, as shown in the Figure 4:

Name	Farm location	Actions
Maccarese S.p.A - Nord	Viale di Castel San Giorgio, 00054, Fiumicino, Roma, ITA	
Maccarese S.p.A	Viale di Castel San Giorgio, 00054, Fiumicino, Roma, ITA	
Farm Cantore Lecce	Gallipoli, Lecce, ITA	
Maccarese S.p.A - Nord [Copy]	Viale di Castel San Giorgio, 00054, Fiumicino, Roma, ITA	
Maccarese Sud	Via Tullio Giordana, 00128, Roma, ITA	
Maccarese Sud [Copy]	Via Tullio Giordana, 00128, Roma, ITA	

Figure 4: View Farm – select farm

The user can then see the farm details as shown in the Figure 5:

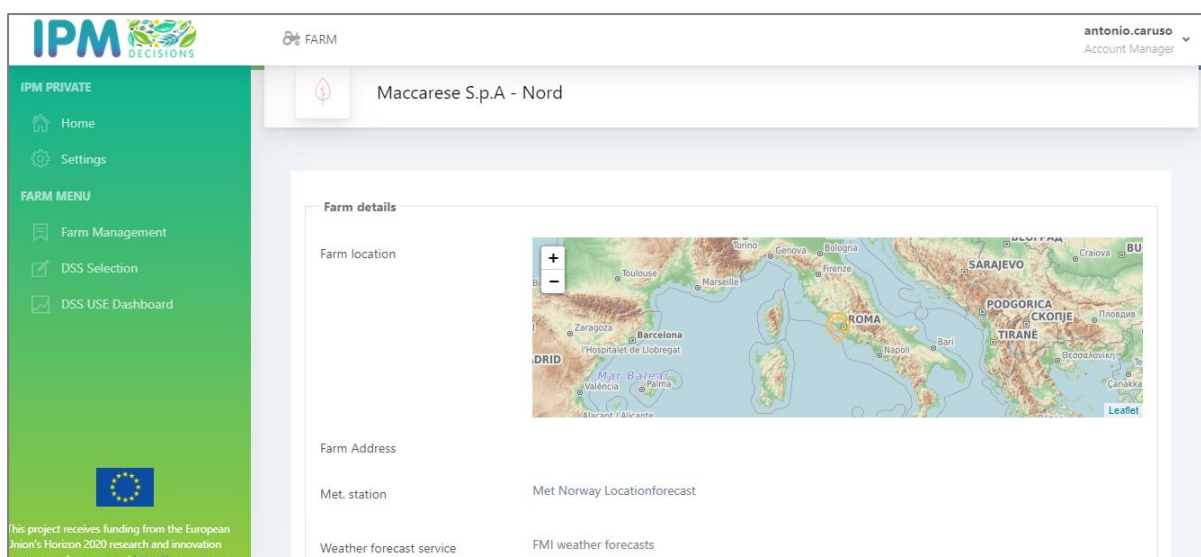


Figure 5: View Farm - details

3.2.4 Copy Farm

The farm copy function was introduced to allow a farmer or an advisor to create a new farm starting from the definition of an existing one. This “facilities” makes the creation work easier and faster going in the direction of simplifying the functions of the IPM portal. This function is available in the farm actions list and reachable from the farm list. The user has to choose the farm from which to start and click on the “copy” icon. The new farm will be distinguishable in the list as the "copy" label will also be shown in the farm name column as shown in the following screenshot.

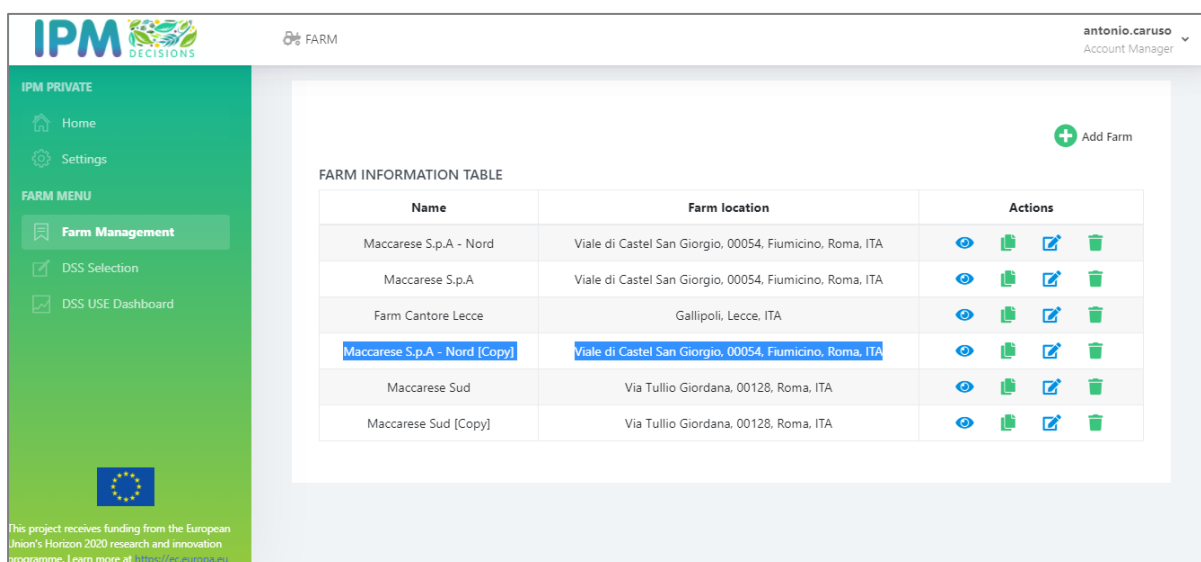


Figure 6: Copy Farm

The data of the copied farm can be further modified using the relative editing action.

3.2.5 Delete Farm

This function allows the deletion of data relating to a farm from the database in which they are stored. This action is irreversible, for this reason the system, before allowing the user to delete a farm, asks for confirmation via a pop-up as shown in the Figure 7:

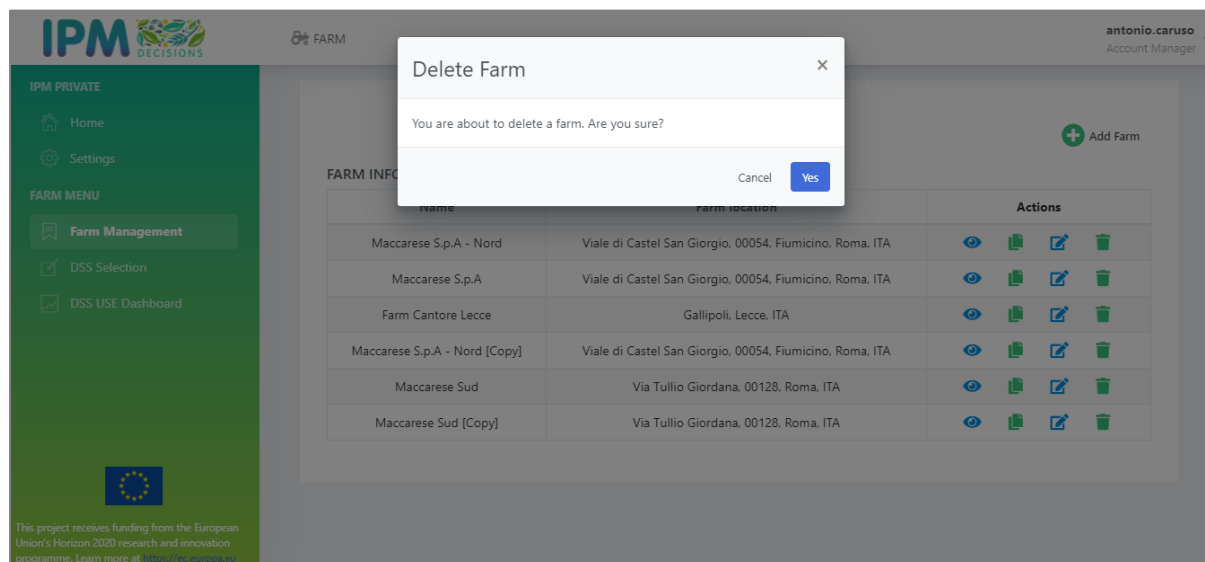


Figure 7: Delete Farm

If the user chooses to access the deletion, then clicking on the "Yes" button of the pop-up, at the end of the process the farm and all its associated data will no longer be visible.

3.2.6 Edit farm

Through this web page, the user can edit the farm name and/or change the farm location on the map. The user can select a different weather data station through the field "Nearest met. Station" and a different weather forecast service through the field "Weather forecast service".

Through this page, the user is also able to associate a Crop/Pest combination to a farm by editing or adding entries to the table listing the crop-pest combinations for the farm. All changes can then be saved by clicking on the Save button.

IPM PRIVATE

Home

Settings

FARM MENU

Farm List

DSS Selection

DSS USE Dashboard

FARM MENU

Farm List

DSS Selection

DSS USE Dashboard

masinicoletti Account Manager

Maccarese S.p.A.

Farm details

Farm location

Farm Address

Met. station

Weather forecast service

Met Norway Locationforecast

FMI weather forecasts

Back

CROP INFORMATION TABLE

Add Crop / Pest combination

Crop	Pest/Disease	Action
No fields available.		

Figure 8 Edit farm

3.2.7 Add crop/pest combination

This form enables the user to associate a crop/pest combination with a farm by selecting a specific crop and then a specific pest (both represented as EPPO codes) that the user is interested in. Then the user has to select the variety and a specific sowing date for that crop.

IPM PRIVATE

Home

Settings

FARM MENU

Farm List

DSS Selection

DSS USE Dashboard

FARM MENU

Farm List

DSS Selection

DSS USE Dashboard

masinicoletti Account Manager

Maccarese S.p.A.

Farm details

Farm location

Farm Address

Met. station

Weather forecast service

Met Norway Locationforecast

FMI weather forecasts

Back

CROP INFORMATION TABLE

Add Crop / Pest combination

Crop	Pest/Disease	Action
TRZAW (SOFT WHEAT (WINTER))	BROMO (BROMUS HORDEACEUS)	
1BRSG (BRASSICA)	AETCY (AETHUSA CYNAPLUM)	

Add crop/pest combination

FARM: Maccarese S.p.A.

Select crop and pest

Crop

DAUCS - Daucus carota subsp. sativus

Pest

PSILRO | Chamaepsila rosae

Select variety and sowing date

Variety

variety custom

Sowing date

01/05/2021

Back

Save

Figure 9 Add crop/pest combination



It is anticipated that for future versions of the platform, the requirement to select a variety will be dropped so that a variety is only specified if that information is required by a DSS.

3.2.8 Edit crop/pest combination

Through the CROP INFORMATION TABLE, the user is able to edit the crop-pest combination, duplicate the crop-pest combination, delete the crop-pest combination, add a pest observation, add a spray or view crop-pest details.

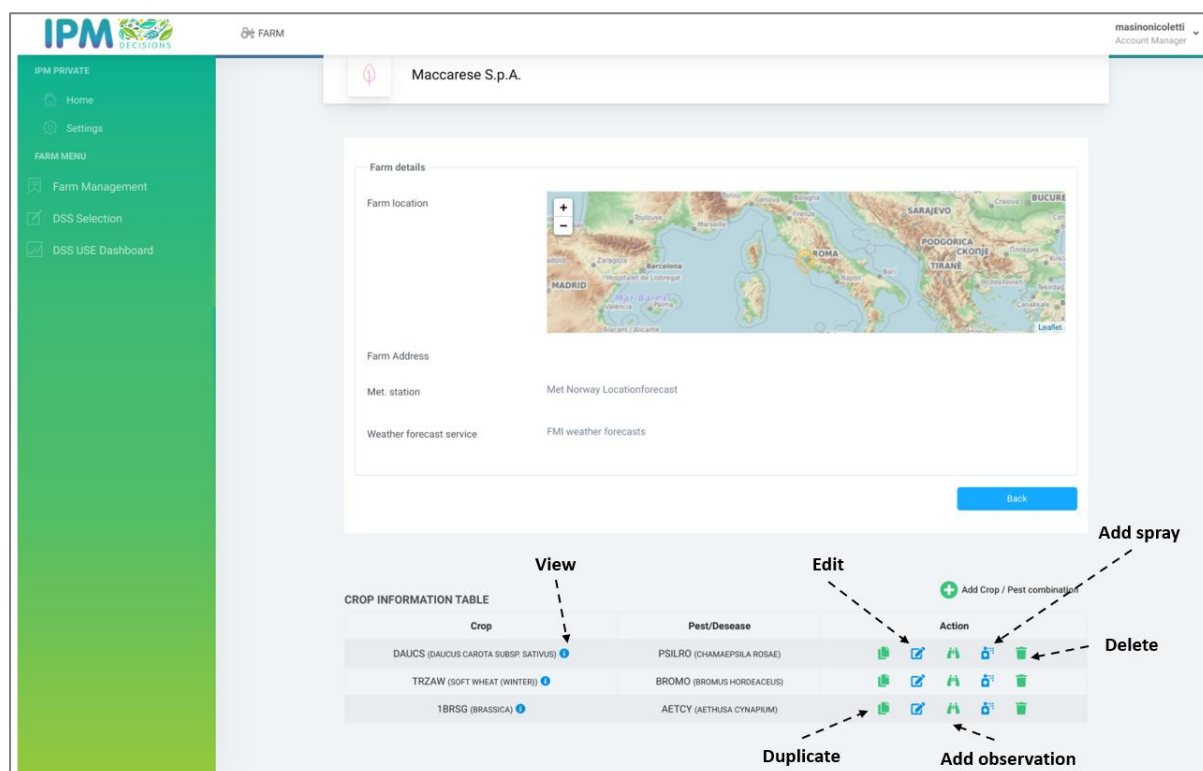


Figure 10 Crop Information Table

Through the “Edit crop-pest combination” action, the user can edit all the crop-pest combination added, as well the variety and the sowing date (Figure 11).

Through the “Delete crop-pest combination” action, the user can delete a specific crop-pest combination (Figure 12).

Through the “Add pest observation” action, the user can add a new pest observation with a date (Figure 13).

Through the “Add spray” action, the user can add a new spray application indicating the product name, the date of the application and the rate (Figure 14).

Through the “View crop-pest details” action, the user can see all the details already entered for that crop (variety, sowing date, sprays applied, list of DSSs and pest observations) (Figure 15).

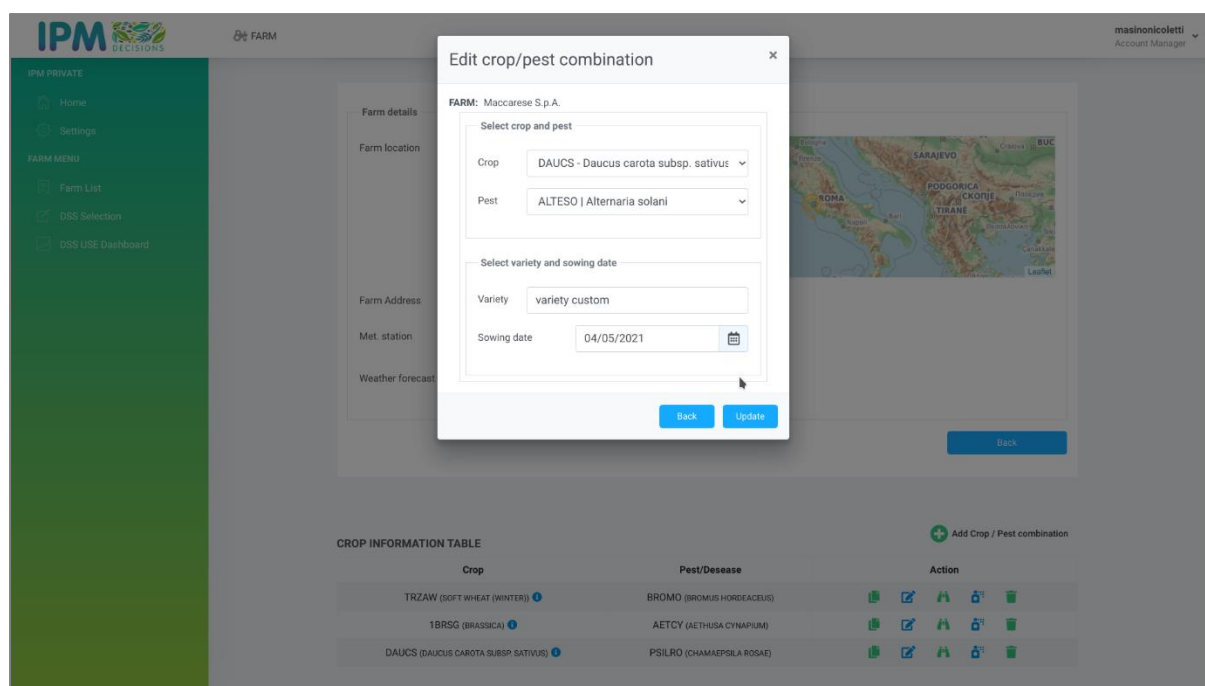


Figure 11 Edit crop-pest combination

3.2.9 Delete Crop/Pest combination

This function allows a user farmer or advisor, to delete a crop/pest combination from the *Crop Information Table*. This action can only be performed by the farmer/advisor who accesses the Farm data. As shown in the figure below, in the action column of the table, the user just needs to click on the "trash can" icon to perform this action. When the user clicks, the system will warn the user of the potential risk of data deletion with a pop-up message. If the user chooses to click on the "Yes" button, the request will be processed by the server and the data will be permanently deleted from the database; if the user chooses not to do so, they will have to click on the "Cancel" button.



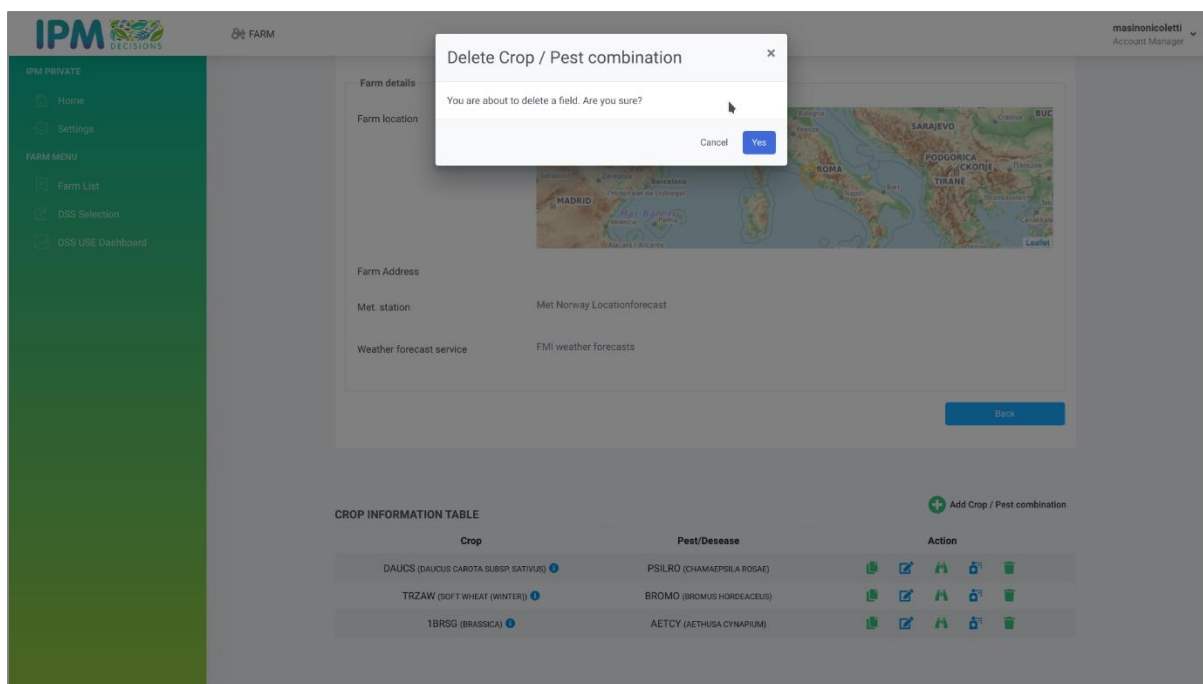


Figure 12 Delete crop-pest combination

3.2.10 Add Observation

The function allows a farmer or advisor to add observations to a crop/pest combination. To perform this action, the user selects the crop/pest combination from the Crop information Table by clicking on the "eye" icon in the action column. A pop-up to enter data is opened by the system, as shown in Figure 13. The user can enter the date (helped by the system through a graphic widget that allows you to enter any date in a simple and intuitive way) and severity of the observation found relating to a pest; clicking on the "+" icon the new observation will be added. In this case, the user is not informed by the system with a message of successful insertion as the observation will be visible immediately after clicking on the "+" icon in the table below the insertion form. It will be possible to insert more observations, and the user will always be able to view the list of observations entered in the system at any time, reaching this functionality from the actions of the Crop Information Table.

This feature is still in development and there is a need to ensure that appropriate units of measure are used for different pests, and that the unit of measure is linked to the DSS selected by the user – such that the user can only add an observation if the DSS is able to use it to calculate risk.



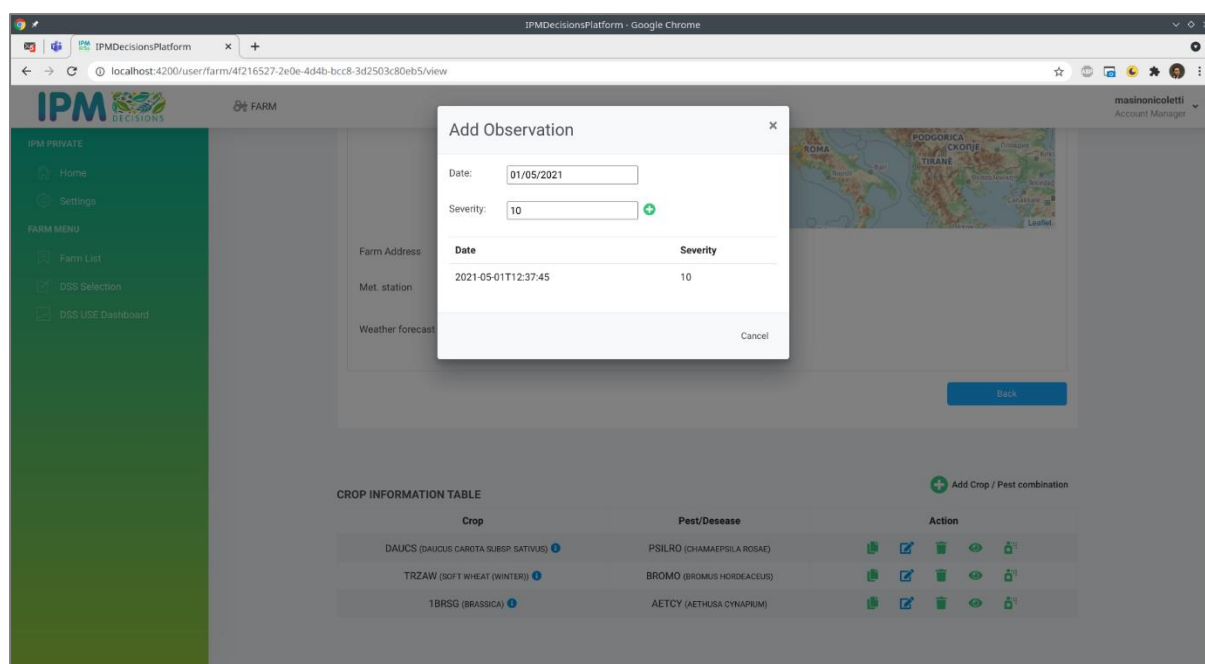


Figure 13 Add pest observation

3.2.11 Add Spray

The function allows a farmer or advisor to add an activity or series of spraying activities performed on a given crop/pest combination. To perform this action, the user selects the crop/pest combination from the Crop information Table by clicking on the "spray" icon in the action column. A pop-up to enter data is opened by the system, as shown in Figure 14. The user can add the spray name or a simple description of the activity that is going to be performed or that has already been carried out through a free text field, the spray date (helped by the system through a graphic widget that allows you to enter any date in a simple and intuitive way) and the spray rate, a numeric field, where the user can add the value. Clicking on the "+" icon the new spray information will be added to the database. In this case, the user is not informed by the system with a message of successful insertion of the spray application, since it will be visible immediately after clicking on the "+" icon in the table below the form fields. It will be possible to insert more spray applications, and the user will always be able to view the list of observations pushed into the system at any time, reaching this functionality from the actions of the Crop Information Table. This feature is still in development and will need to be linked to the DSS, in the same way as the "Add observation" to avoid the IPM Decision Platform from having to maintain a comprehensive list of all crop protection products. However, a simple version where users are able to specify the date and type (fungicide, herbicide, pesticide) of spray may be used for general information.

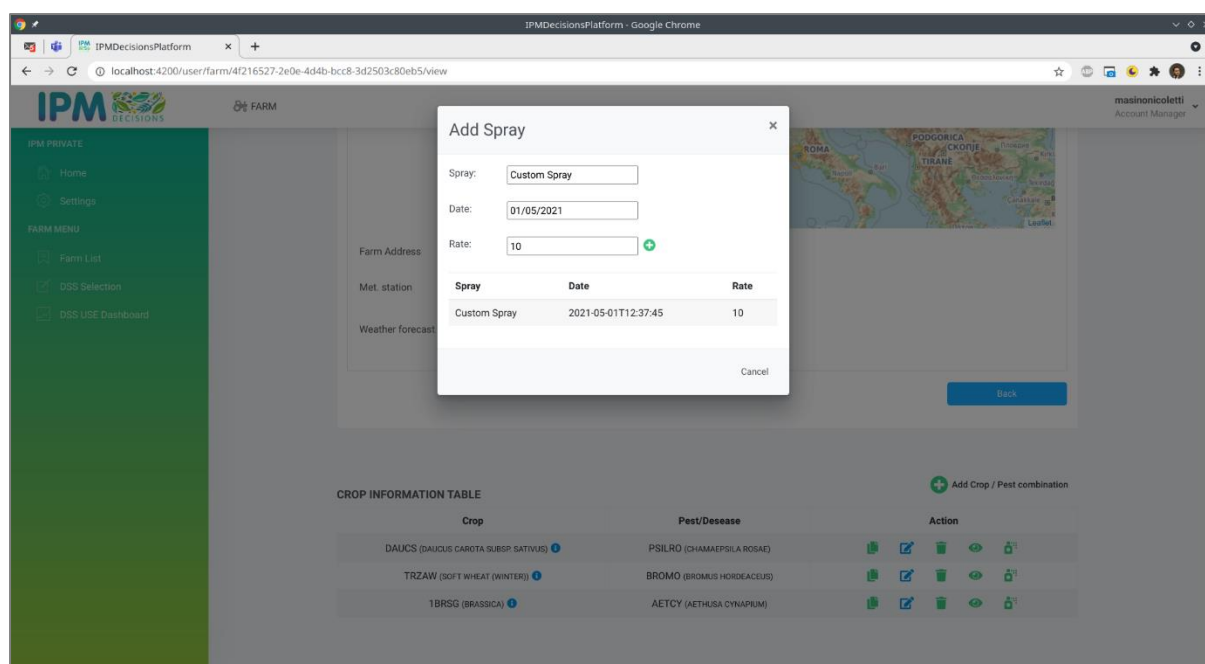


Figure 14 Add spray

3.2.12 Crop Details

The facility allows a farmer or advisor to visualise all the information provided by the user concerning the variety, the sowing date, the observations and the spray applications in an aggregate view. This view will also help them understand which DSSs are associated with each crop. To access the view, the user locates the crop in the Crop Information Table, clicks on the "i" (information) icon. The system opens a pop-up that contains information relating to the variety, the sowing date, the list of sprays, the observations and the DSS available with the relative parameters.



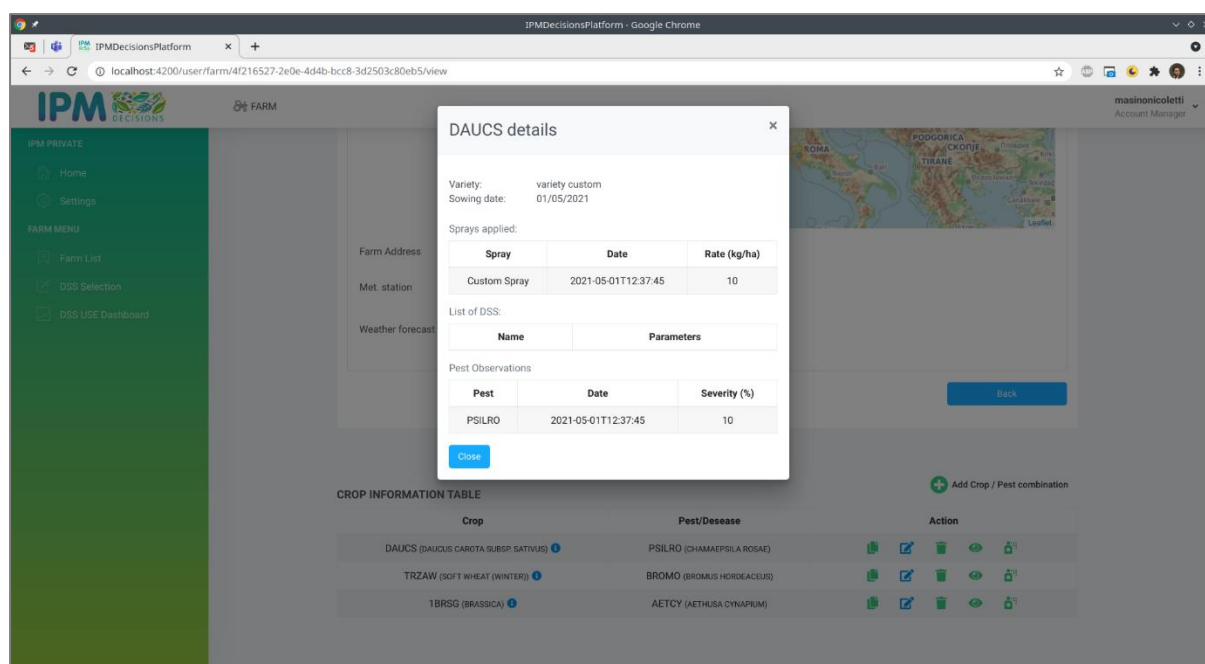


Figure 15 Crop-pest details

3.3 DSS Selection

Through this interface, the user can obtain the list of all DSSs that are available to be used to provide information on risk for a selected crop-pest combination (Figure 16).

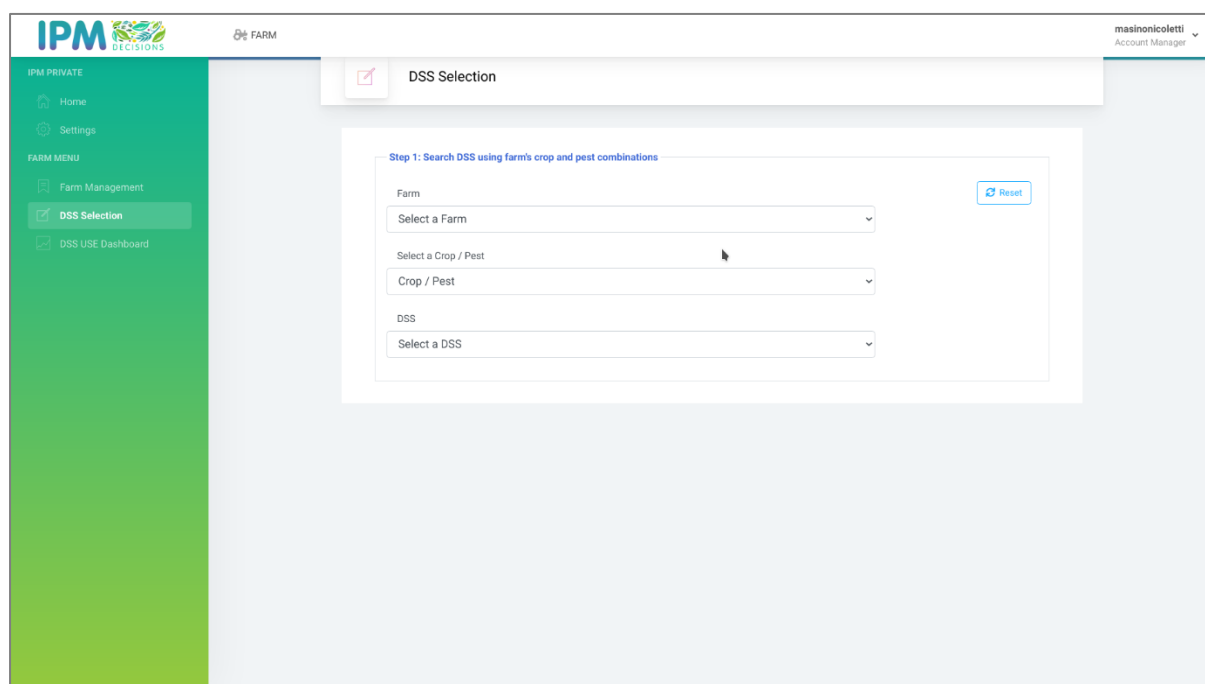


Figure 16 Step 1 - Search DSS using crop and pest combination

Once the system gets back the list of DSSs that match the selected crop-pest combination, the user can select the DSS to use to provide information on the risk for the crop/pest combination (Figure 17 Step 1 - Select DSS).

Figure 17 Step 1 - Select DSS

At the same time, if the DSS requires additional inputs (beyond weather data or sowing date) the user will see a list of all the parameters where user input is necessary. This view, shown in Figure 18, it is rendered automatically by the system; which means that each DSS will be associated with a different view based on the user inputs required. This approach is facilitated by the use of a JSON schema format, managed by the backend services of the IPM Portal, linked to a framework on dynamic data visualization. The json-editor³ technology was used to render the json template which is capable of generating forms automatically starting from an output model. The CSS⁴ stylesheet of the IPM Web Portal was then applied to the visualization dashboard. A JSON document is an information resource (series of octets) described by the application/json media type. JSON Schema⁵ is a JSON media type for defining the structure of JSON data. JSON Schema is only defined over JSON documents. Any document or memory structure that can be parsed into or processed according to the JSON Schema data model can be interpreted against a JSON Schema. The technical staff involved in this activity agreed on JSON Schema to share the data model with fields and default values of DSS, because it needs a well defined set of data that could be filled by the user that navigates through the web platform. In order to provide such technology we chose a component called JSON Editor. JSON Editor takes a JSON Schema and uses it to generate an HTML form. It

³ <https://github.com/json-editor/json-editor>

⁴ https://www.w3schools.com/whatis/whatis_css.asp

⁵ <https://json-schema.org/draft/2020-12/json-schema-core.html>

integrates with several popular CSS frameworks, and Bootstrap is the one we have chosen for the web platform, in order to keep the rendering in a clean fashion and to let the user not understand that there is an automated external library that takes in charge this functionality for DSS. Furthermore, together with JSON Editor has been used AJV⁶ Validator that improves valid.

Figure 18 Step 2 – DSS Parameters

An example of how the visualisation might change based on the selected DSS is shown in Figure 19 and Figure 20.

⁶ <https://github.com/ajv-validator/ajv>

Figure 19 – DSS parameters changed according to the DSS

Figure 20 - DSS parameters changed according to the DSS

Figure 21, below, shows how the system behaves in case there are no crop-pest combinations associated with a particular Farm. The system at this point prompts the user to create a new one, showing the "Add Crop/Pest combination" button for that specific farm.



Figure 21 – No crop and pest combination available for the Farm

3.4 DSS Use dashboard

The DSS Use Dashboard, represents one of the first functional outputs from the IPM Decisions project and of the joint technical work of WP2 and WP3. To achieve this goal, the partners involved have collaborated very closely, with a lot of iterative work between the two work packages. The dashboard benefits from the result of other IPM Web Portal features, such as those described in this document, in the previous sections.

A farmer or advisor user can access the DSS Use Dashboard directly from the left user menu, although it has anticipated that future releases will ensure that once DSS have been selected, the user is taken to this dashboard page by default on login. The dashboard shows the list of DSS selected by the user, arranged by Crop type. The boxes are colour-coded to represent the degree of risk (Figure 18) and also have the name of the pest displayed in the box, with the DSS name underneath the box.

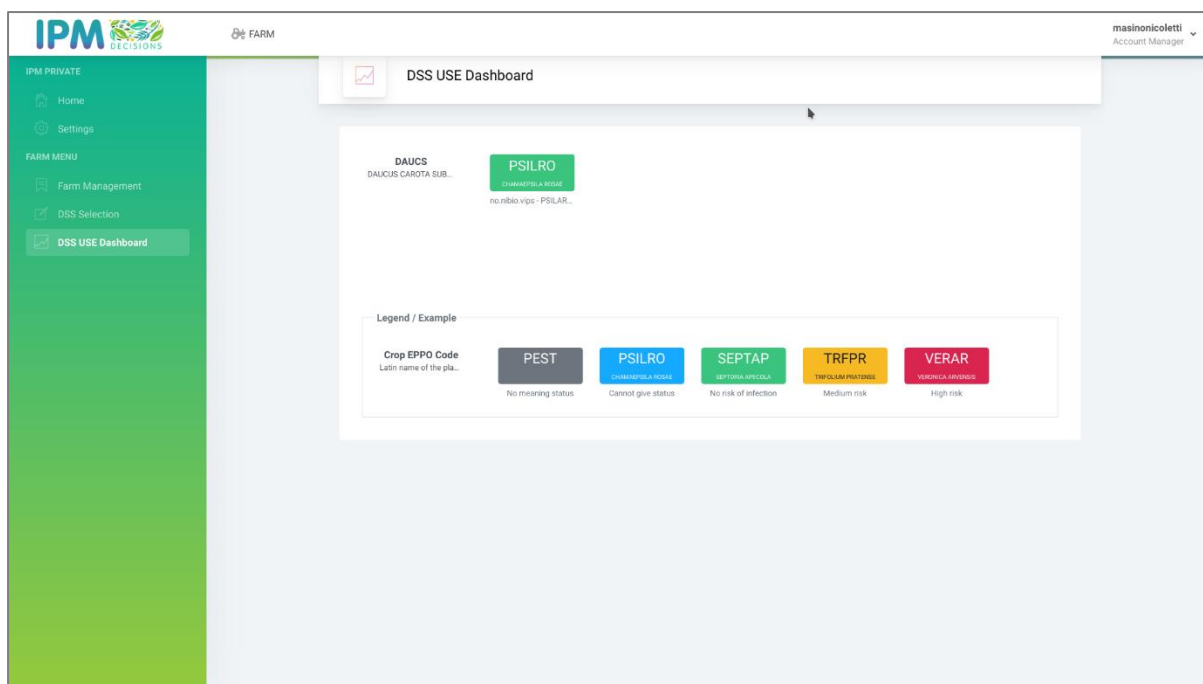


Figure 22 DSS Use dashboard

If the user clicks on a coloured box, a more detailed display of the output provided by the DSS is displayed, as shown in Figure 23, Figure 24 and Figure 25.

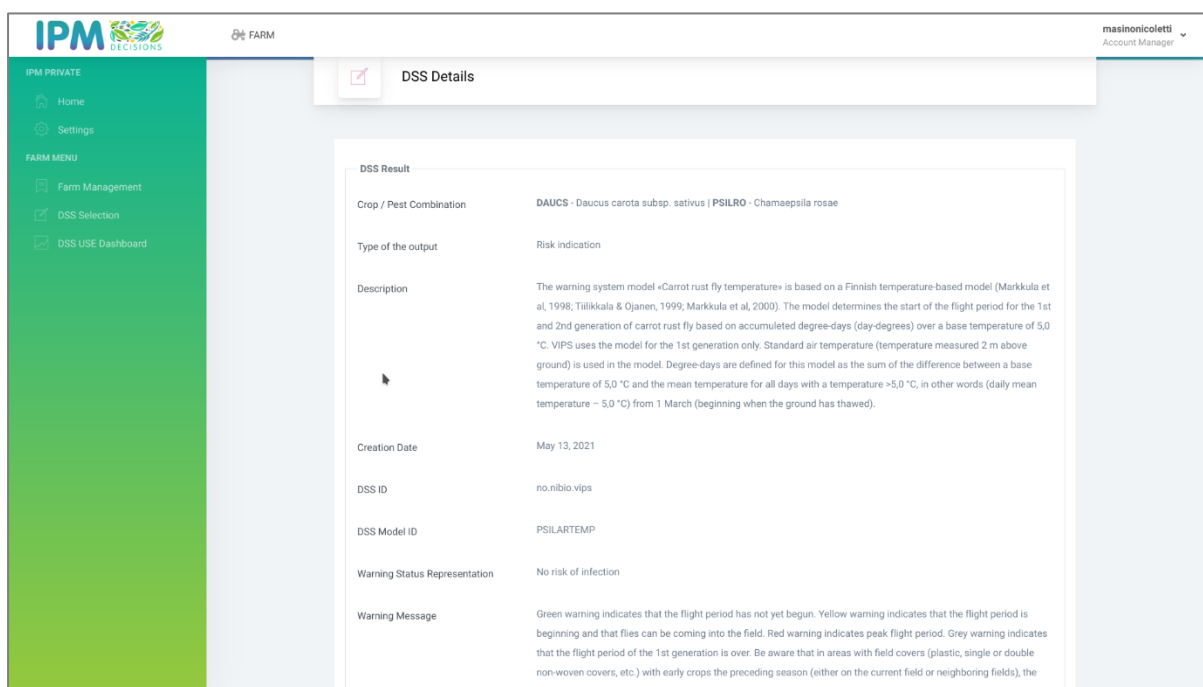


Figure 23 DSS Output [1/3]



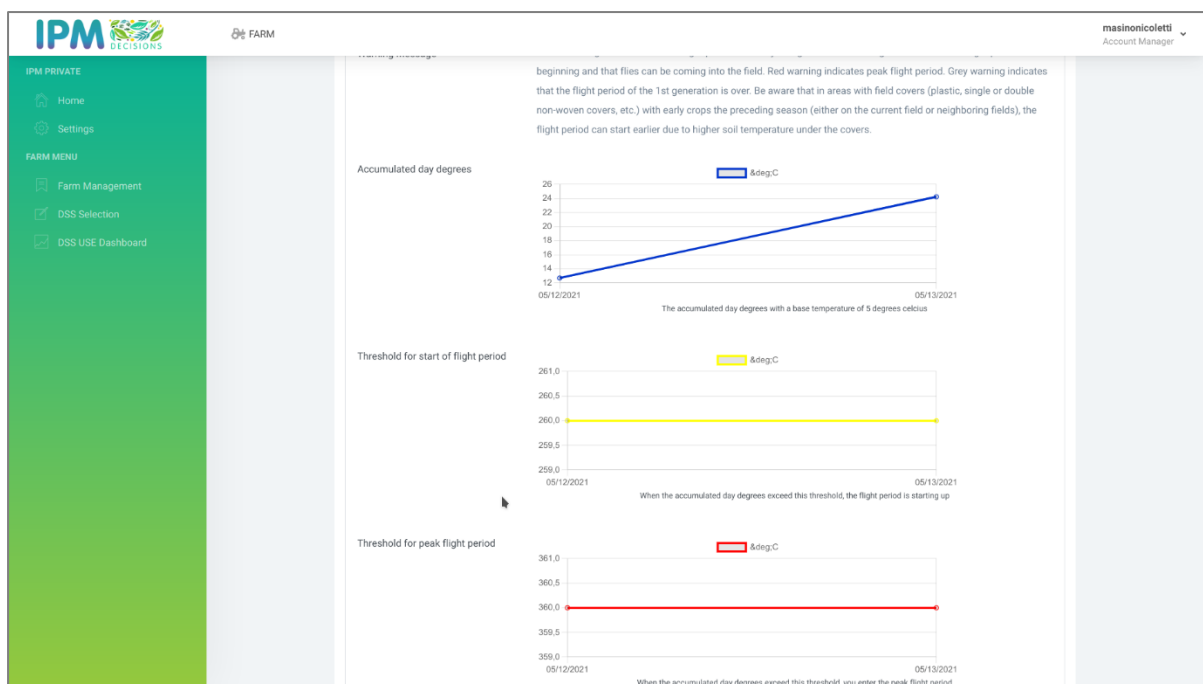


Figure 24: DSS Output [2/3]

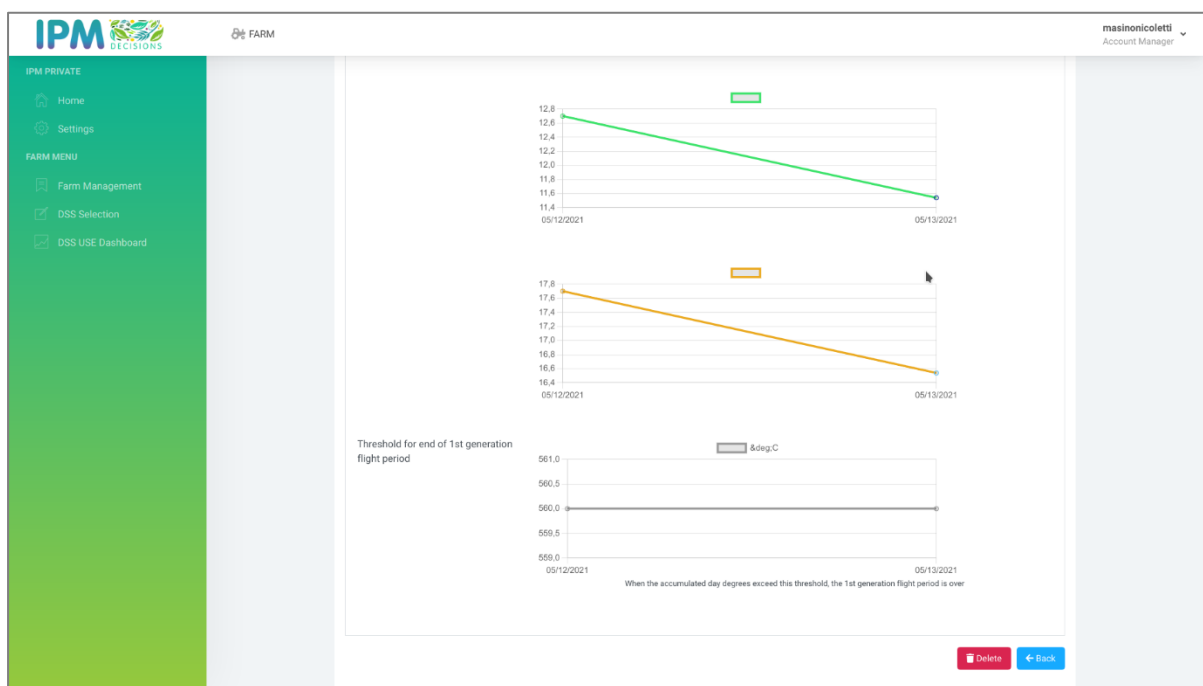


Figure 25: DSS Output [3/3]

The detailed DSS results show, for each output parameter, a graph of that parameters values from the current day up to seven days in the future.



4 Verification plan

The verification plan is used to ensure that the dashboard is successfully integrated into the IPM Decisions platform and performs as described during the design phase of the project.

The Verification Plan describes the process that IPM Decisions implementations have to follow in order to be able:

- to verify that each application offers the functionality that was envisioned during the design phase, and
- to verify that the integration between each of the application has been successfully carried out.

This is realized through a set of Test Levels that can be executed upon them.

According to the International Software Testing Qualifications Board's (ISTQB's) Agile Test Extension the following test levels can be defined:

Unit testing (also known as unit, module, or program testing) searches for defects in, and verifies the function of, software modules programs, objects, classes, etc., that are separately testable. It may be done in isolation from the rest of the system, depending on the context of the development life cycle and the system. Such tests will facilitate the verification at component level (unit-test).

Functionality testing validates the functionalities provided by the Farm Management, DSS Selection and DSS Use dashboard. It provides, in a tabulated format, the summary of the functionalities provided by each single application. They indicate, whether a specific functionality (feature) is fully implemented, partially implemented, or not implemented.

Integration testing evaluates the interfaces between components, interactions with different parts of a system and interfaces between systems. Systematic integration strategies may be based on system architecture (such as top-down and bottom-up), functional tasks, transaction processing sequences or some other aspect of the system or components.

Due to the integrated and connected nature of the components of the IPM Decisions Platform, all of the testing to date has been done through integration and functionality tests.

4.1 Functionality and integration tests implemented to date

4.1.1 Farm Management

Test 01	FM_01
Test description	List all farm by a farmer user
Functionality under test	Discovering farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning
Steps	<ol style="list-style-type: none">1. Access to the IPM Web Portal2. Obtains grant on IPM Web Portal3. Farm visualisation
Pass criteria	User has access to list of all farms

Table 1: Functionality Test - List all farm by a farmer user

Test 02	FM_02
Test description	Add new Farm
Functionality under test	Add new Farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning, Weather and model metadata APIs
Steps	<ol style="list-style-type: none">1. Farm list2. Add farm3. Add farm form filling4. Click on the save button5. View the new farm in the farm list
Pass criteria	The new farm is visible in the farm list

Table 2: Functionality Test - Add new Farm

Test 03	FM_03
Test description	View Farm
Functionality under test	View Farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning, Weather and model metadata APIs
Steps	<ol style="list-style-type: none">1. Farm list2. View farm action3. View the farm detail
Pass criteria	The details of the farm are visible on the detail pages

Table 3: Functionality Test – View Farm

Test 04	FM_04
Test description	Copy farm
Functionality under test	Copy farm from an existing one
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning
Steps	<ol style="list-style-type: none"> 1. Farm list 2. Copy farm action 3. View the new farm in the farm list
Pass criteria	The new farm copied from an existing one is visible in the farm list

Table 4: Functionality Test – Copy Farm

Test 05	FM_05
Test description	Edit Farm
Functionality under test	Edit existing farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning, Weather and model metadata APIs
Steps	<ol style="list-style-type: none"> 1. Farm list 2. Edit farm action 3. Edit farm page 4. Farm data changing 5. Click on the save button 6. View the new farm in the farm list 7. Click farm detail action
Pass criteria	The new data related to the farm are visible in the farm detail page

Table 5: Functionality Test – Edit Farm

Test 06	FM_06
Test description	Delete farm
Functionality under test	Delete existing farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning
Steps	<ol style="list-style-type: none"> 1. Farm list 2. Delete farm 3. Alert message visualisation 4. Click on the yes button 5. The farm is no longer in the farm list
Pass criteria	The farm is not visible in the farm list

Table 6: Functionality Test - Delete existing farm

Test 07	FM_07
Test description	Add Crop/Pest combination
Functionality under test	Add Crop/Pest combination to an existing farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning
Steps	<ol style="list-style-type: none"> 1. Farm list 2. View farm action or edit farm action 3. Click on Add Crop/Pest Combination link 4. Add Crop/Pest combination from form filling 5. The new crop/pest combination is visible in the Crop information table
Pass criteria	The new crop/pest combination is visible in the in the Crop information table

Table 7: Functionality Test: Add Crop/Pest combination

Test 08	FM_08
Test description	Copy Crop/Pest combination
Related requirements	
Functionality under test	Copy Crop/Pest combination to an existing farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning
Steps	<ol style="list-style-type: none"> 1. Farm list 2. View farm action or edit farm action 3. Click Copy Crop/Pest Combination action 4. The new crop/pest copied from an existing crop/pest combination is visible in the Crop information table
Pass criteria	The new crop/pest combination is visible in the in the Crop information table

Table 8: Functionality Test: Edit Crop/Pest combination



Test 09	FM_09
Test description	Add observation
Functionality under test	Add observation to an existing crop/pest information related to an existing farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning
Steps	<ol style="list-style-type: none"> 1. Farm list 2. View farm action or edit farm action 3. Click on the Add Observation action 4. Add observation from form filling 5. The new observation is visible in the Crop information table clicking on Add observation action
Pass criteria	The new observation is visible in the Crop information table clicking on Add observation action

Table 9: Functionality Test: Add observation

Test 10	FM_10
Test description	Add spray
Functionality under test	Add spray to an existing Crop/Pest combination to an existing farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning
Steps	<ol style="list-style-type: none"> 1. Farm list 2. View farm action or edit farm action 3. Click on Add Spray action 4. Add spray information from form filling 5. The new spray observation is visible in the Crop information table clicking on Add spray action
Pass criteria	The new spray observation is visible in the Crop information table clicking on Add spray action

Table 10: Functionality Test - Add spray

Test 11	FM_11
Test description	Delete crop/pest combination
Functionality under test	Delete Crop/Pest combination to an existing farm
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning
Steps	<ol style="list-style-type: none"> 1. Farm list 2. View farm action or edit farm action 3. Click Delete crop/pest combination action 4. Alert message visualisation 5. Click on the yes button 6. The crop/pest combination is no longer visible in the Crop information table
Pass criteria	The crop/pest combination is no longer visible in the Crop information table

Table 11: Functionality Test - Delete crop/pest combination

Test 12	FM_12
Test description	Crop detail
Functionality under test	Crop detail visualisation
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, User Provisioning
Steps	<ol style="list-style-type: none"> 1. Farm list 2. View farm action or edit farm action 3. Click on information icon in the Crop information table 4. Crop detail visualization
Pass criteria	A pop-up shows the details of a crop, the associated observations, the spray, and the list of DSS parameters associated with the crop / pest combination

Table 12: Functionality Test - Crop detail

4.1.2 DSS Selection

Test 01	DSS_SEL_01
Test description	DSS Selection Step 1
Functionality under test	Visualisation of step 1 of the selection of a DSS
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, Weather and model metadata APIs, DSS catalogue
Steps	<ol style="list-style-type: none"> 1. DSS Selection 2. Search DSS using farm's crop and pest combinations visualization form 3. Farm selection 4. Crop/pest combination selection 5. DSS selection
Pass criteria	New form visualisation with the parameters associated with the selected DSS

Table 13: Functionality Test - DSS Selection Step 1

Test 02	DSS_SEL_02
Test description	Save DSS selection
Functionality under test	Saving DSS parameters
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, Weather and model metadata APIs, DSS catalogue
Steps	<ol style="list-style-type: none"> 1. DSS Selection 2. Search DSS using farm's crop and pest combinations visualization form 3. Farm selection 4. Crop/pest combination selection 5. DSS configuration parameters filling 6. Save data
Pass criteria	Saving of parameters related to a DSS selected based on crop/pest combination associated with a farm

Table 14: Functionality Test - Saving DSS parameters

4.1.3 DSS Use dashboard

Test 01	DSS_USE_01
Test description	DSS Use Dashboard visualization
Functionality under test	Visualisation of DSS Use Dashboard
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, Weather and model metadata APIs, DSS catalogue
Steps	<ol style="list-style-type: none"> 1. DSS Use Dashboard 2. DSS Visualisation
Pass criteria	Visualisation of the DSS chosen in the DSS selection function, and the related risk level

Table 15: Functionality Test - DSS Use Dashboard visualization

Test 02	DSS_USE_02
Test description	DSS output visualization
Functionality under test	DSS output visualization
Test environment	NIBIO cloud, Azure Cloud
Dependencies	Microservice: Authentication & Authorization Service, Weather and model metadata APIs, DSS catalogue
Steps	<ol style="list-style-type: none"> 1. DSS Use Dashboard 2. DSS selection 3. DSS output
Pass criteria	Visualisation of the DSS output related to DSS Use Dashboard DSS list

Table 16: Functionality Test - DSS output visualization



4.2 Integration test

Test 01	IT_01
Test description	IPM Web Portal requests access to private page
Module(s) under test	IPM Web Portal
Module(s) under test environment	Authentication and Authorization Service
Test environment	NIBIO cloud, Azure Cloud
Dependencies	API Gateway
Steps	<ol style="list-style-type: none"> 1. IPM Web Portal send username and password to Authentication and Authorization Service 2. Authentication and Authorization Service check if those user credentials exist into database and if they are valid 3. Authentication and Authorization Service checks if email is confirmed to allow use of the platform
Pass criteria	The IPM Web Portal private page is shown to the user

Table 17: Integration Test - IPM Web Portal request access to private page

Test 02	IT_02
Test description	IPM Web Portal requests the list of farms filtered by user to User Provisioning Service
Module(s) under test	IPM Web Portal
Module(s) under test environment	Authentication and Authorization Service, User Provisioning
Test environment	NIBIO cloud, Azure Cloud
Dependencies	API Gateway
Steps	<ol style="list-style-type: none"> 1. IPM Web Portal send username and password to Authentication and Authorization Service 2. Authentication and Authorization Service check if those user credentials exist into database and if they are valid returns a unique encoded token 3. IPM Web Portal Request to User Provisioning Service the list of farms associated with user 4. User Provisioning Service returns the list of farms in Json format
Pass criteria	The User Provisioning Service returns the list of farms associated with the user who logged in

Table 18: Integration test - IPM Web Portal request the list of farms filtered by user to User Provisioning Service



Test 03	IT_03
Test description	IPM Web Portal requests the list of DSS filtered by farm to Decision Support Tool Service
Module(s) under test	IPM Web Portal
Module(s) under test environment	Authentication and Authorization Service, User Provisioning, Decision Support Tool Service
Test environment	NIBIO cloud, Azure Cloud
Dependencies	API Gateway
Steps	<ol style="list-style-type: none"> 1. IPM Web Portal send username and password to Authentication and Authorization Service 2. Authentication and Authorization Service check if those user credentials exist into database and if they are valid returns a unique encoded token 3. IPM Web Portal Request to User Provisioning Service the list of farms associated with the logged in user 4. User Provisioning Service contact Decision Support Tool Service, that returns the list of DSS related to a farm in Json format
Pass criteria	The Decision Support Tool Service returns the list of DSS associated to a farm with the user who logged in the IPM Web Portal

Table 19: Integration test - IPM Web Portal request the list of DSS filtered by farm to Decision Support Tool Service

Test 04	IT_04
Test description	IPM Web Portal requests the list of weather data sources to Weather Service
Module(s) under test	IPM Web Portal
Module(s) under test environment	Authentication and Authorization Service, Weather Service
Test environment	NIBIO cloud, Azure Cloud
Dependencies	API Gateway
Steps	<ol style="list-style-type: none"> 1. IPM Web Portal send username and password to Authentication and Authorization Service 2. Authentication and Authorization Service check if those user credentials exist into database and if they are valid returns a unique encoded token 3. IPM Web Portal request to Weather Service the list of data sources registered into the system



	4. Weather Service returns the list of weather data source in Json format
Pass criteria	Weather data is returned as JSON object and drop downs are populated using filters

Table 20: Integration test - IPM Web Portal request the list of weather data sources to Weather Service

Test 05	IT_05
Test description	User registers on platform and receives and email
Module(s) under test	IPM Web Portal
Module(s) under test environment	Notification Service
Test environment	NIBIO cloud, Azure Cloud
Dependencies	API Gateway
Steps	<ol style="list-style-type: none"> 1. IPM Web Portal send a new username and password to Authentication and Authorization Service 2. Authentication and Authorization Service check username do not exist, and password meets minimum security requirements 3. Authentication and Authorization Service creates a unique token to confirm the email and sends information to Notification Service 4. Notification Service sends email to user with a link to confirm the email with a unique token 5. IPM Web Portal send token and username to Authentication and Authorization Service. This service checks that token belongs to user and confirms email
Pass criteria	Users receives and email with link. User clicks on link, and IPM Web Portal displays successful confirmation email

Table 21: Integration test - IPM Web Portal register a new user

Test 06	IT_06
Test description	User forgets password and receives reset password email
Module(s) under test	IPM Web Portal
Module(s) under test environment	Notification Service
Test environment	NIBIO cloud, Azure Cloud
Dependencies	API Gateway
Steps	<ol style="list-style-type: none"> 1. IPM Web Portal send a username to Authentication and Authorization Service



	<ol style="list-style-type: none"> 2. Authentication and Authorization Service check username exist 3. Authentication and Authorization Service creates a unique token to reset the password and sends information to Notification Service 4. Notification Service sends email to user with a link to reset password with a unique token 5. User submits form with token, username, and password 6. Authentication and Authorization Service checks that token belongs to user and changes password
Pass criteria	Users receives and email with link. User clicks on link, and form is opened. When form is submitted, password is changed

Table 22: Integration test – IPM Web Portal send forgot Password

Test 07	IT_07
Test description	User type advisor request data form user type farmer
Module(s) under test	IPM Web Portal
Module(s) under test environment	Notification Service
Test environment	NIBIO cloud, Azure Cloud
Dependencies	API Gateway
Steps	<ol style="list-style-type: none"> 1. IPM Web Portal sends a data share request to the User Provision Service from an advisor to a farmer. 2. User Provision Service sends request to Authentication and Authorization to check if user email exist on the system. Authentication and Authorization returns user id if exists. 3. User Provision Service sends request to Notification Service to send an email to user type farmer, advising that an advisor has requested access to their data.
Pass criteria	Users receive and email with data share request information. Users can see a data share request on their profile using the IPM Web Portal.

Table 23: Integration test - IPM Web Portal data share request



Test 08	IT_08
Test description	User submits a new DSS to the IPM Web Portal
Module(s) under test	IPM Web Portal
Module(s) under test environment	Notification Service
Test environment	NIBIO cloud, Azure Cloud
Dependencies	API Gateway
Steps	<ol style="list-style-type: none"> 1. IPM Web Portal sends DSS information to the User Provision Service 2. User Provision Service request metadata from the DSS Service to run the DSS. DSS Service returns data as a JSON object. 3. If weather data is needed to run the DSS, the User Provision Service requests weather information to the Weather Service. Weather Service returns data as a JSON object. 4. User Provision Service, merge information from DSS and Weather Services, and send information to DSS owner. 5. DSS owner return results data as a JSON object, and User Provision Service interprets the results using the metadata from the DSS service.
Pass criteria	IPM Web Platform displays the DSS result information.

Table 24: Integration test - IPM Web Portal submits a new DSS



5 Conclusions

This deliverable contains all the information related to the development of the first dashboard envisaged by the Subtask 3.1.2: the DSS Use Dashboard. An iterative approach is being used for Platform development, so other versions and improvements to the current dashboard release are expected over time. Task 3.1.2 is still an ongoing activity, a revised version that includes new development and testing the activities involved in the beta iteration and improvements may be reported in other deliverables of Task 3.1 such as D3.4 and D3.5 to be submitted respectively at M30 and M36.

The next steps in the development of the IPM Decisions platform and DSS Use dashboard will be to create shortcuts that allow the automatic creation of farms based on a minimal entry of data by the user. The DSS output will be made more user-friendly and simpler, so it is more closely aligned with the mock-ups presented in the second round of workshops.

Based on feedback from the 2021 Annual Stakeholder Meeting, there is a need to simplify the data entry. An example is to allow users to select one or more crops on the farm, then to select one or more DSS from a list filtered by the crops on the farm. The platform would then automatically create the farm structure and the crop-pest-DSS combinations based on the user selections. We will also design an appropriate set of icons for the display of the DSS risk outputs.

The aim of these next steps is to produce a streamlined user experience, which makes setting up the system possible in as few “clicks” as possible. Users would then be able to use the existing functionality to make refinements to the crop information and DSS inputs as “advanced” functionality.