LIFE Project Number

<LIFE15 ENV/IT/000641>

Deliverable "Decision tool beta version"

Sub-action B1.2 – Tool's improvement (beta version)

LIFE PROJECT Soil4Wine

1. Introduction

Soil4Wine project "*Innovative approach to soil management in viticultural landscape*" aims to achieve a better soil management in the whole viticultural system developing and testing an innovative Decision tool and management solution tested in farm in Project area and Europe.

This report presents the structure and main outcomes of sub-action B1.2 related to Soil4Wine project Action B.1 " Development of the decision tool " from M7 until M26.

Action B.1 will continue until M36 of the project (31.12.2019) with the production of another Deliverable for the final version of the tool.

UCSC is the responsible for this action with the collaboration of HORTA.

Aim of this sub-action was the development of the beta version of the Decision tool for grape growers making it possible to implement and maintain the best solutions (i.e., soil management practices) for mitigation of the negative effects of soil and environment problems in each specific situation. Despite what was foreseen in the project proposal, the beta version is already an ICT version. As justified in the mid-term report, this change was agreed by the partners to facilitate the testing of the tool by living labs.

2. Description of the tool (beta version)

The Decision tool was designed as a stand-alone tool, meaning that it does not require the intervention of external experts (consultants, specialists, etc.), yet it allows the farmers to self-evaluate their specific problem(s), take right decisions about the necessary mitigation measure(s), implement them following good agricultural practices and, finally, check the success of the intervention. The conceptual scheme of the Decision tool is illustrated in Figure 2.1.

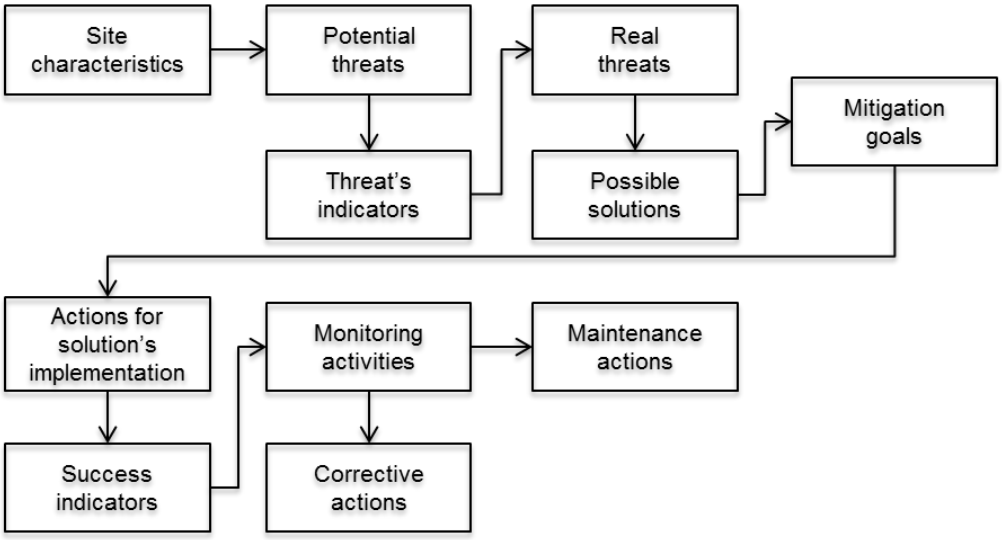


Figure 2.1 - Conceptual scheme of the Decision tool

The beta version of the tool described in this deliverable was developed already as ICT version starting from the alfa version (developed in the first period of the project and described in Deliverable B1.1) and includes all the steps of the conceptual scheme presented in Figure 2.1.

The Decision tool is composed by the following modules:

a. a checklist for describing the site characteristics;
b. a computing engine using the site attributes to provide synthetic numerical indexes and ratings (from low to high risk) related to the soil potential threats;
c. a second checklist to verify whether the potential risk provided by the computing engine are real or not;
d. a decision engine suggesting best practices in order to decrease the risk of soil threats;
e. a registration module to register the activities performed in the vineyard;
f. a third checklist to be used in order to perform an objective evaluation of the soil's threats changes after the implementation of the mitigation actions.

Following the single modules are described in details and snapshots of the ICT version are presented:

a. Definition of the site

In the first step, the farmer defines the site (e.g., a vineyard with its surroundings), for which he wants to use the decision tool, by clicking on the icon and inputting information on its characteristics (almost all are "close choices" through trop down menus to facilitate the user), and in particular:

Characteristics of the site (Figure 2.2):

- Name of the vineyard
- Surface (ha)
- Nation, Region, Town
- Geographical coordinates
- Altitude (m.s.l.)
- Average slope
- Average aspect

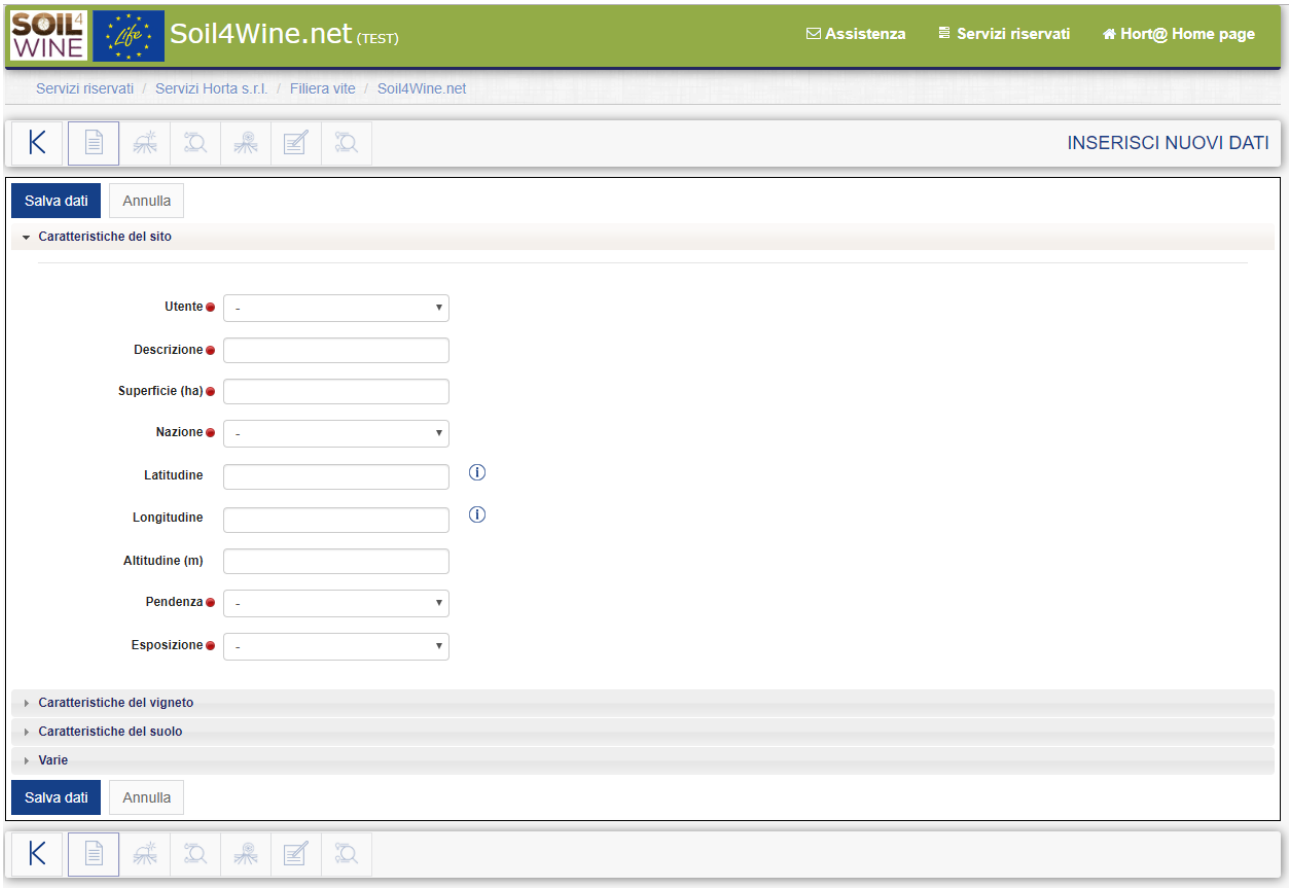


Figure 2.2 – Snapshot of the user interface to input data about the characteristics of the site

Characteristics of the vineyard (Figure 2.3):

- Grapevine variety
- Root stock
- Trellis system
- Distance between rows (m)
- Distance between vines along the rows (m)
- Row orientation
- Farming practices of ploughing: contour plow, ploughing along maximum slope, crossing ploughing
- Row length (m)

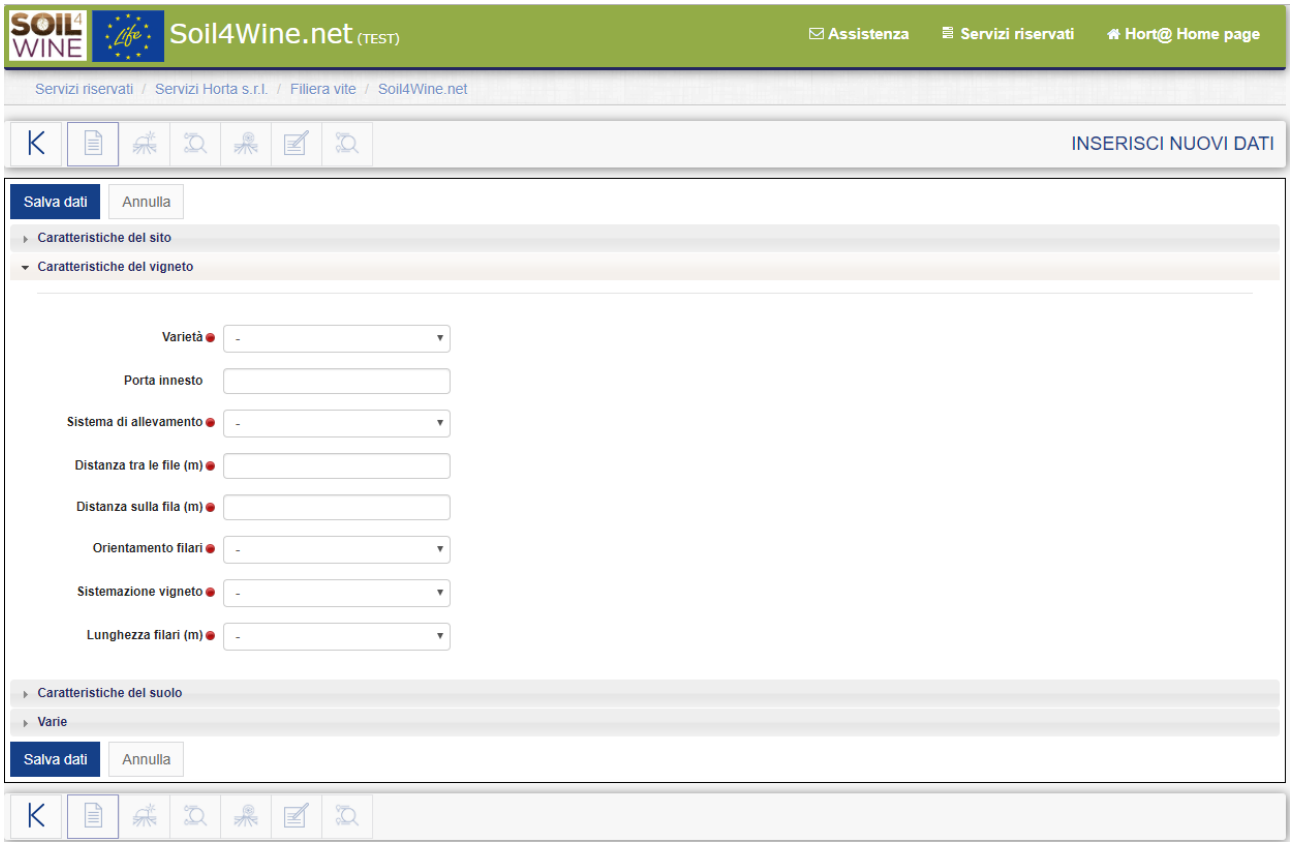


Figure 2.3 – Snapshot of the user interface to input data about the characteristics of the vineyard

Soil characteristics (Figure 2.4):

- Floor management between rows
- Floor management on the row
- Gravel
- Soil texture
- Root depth (cm)
- Groundwater depth
- Soil organic matter
- Drainage

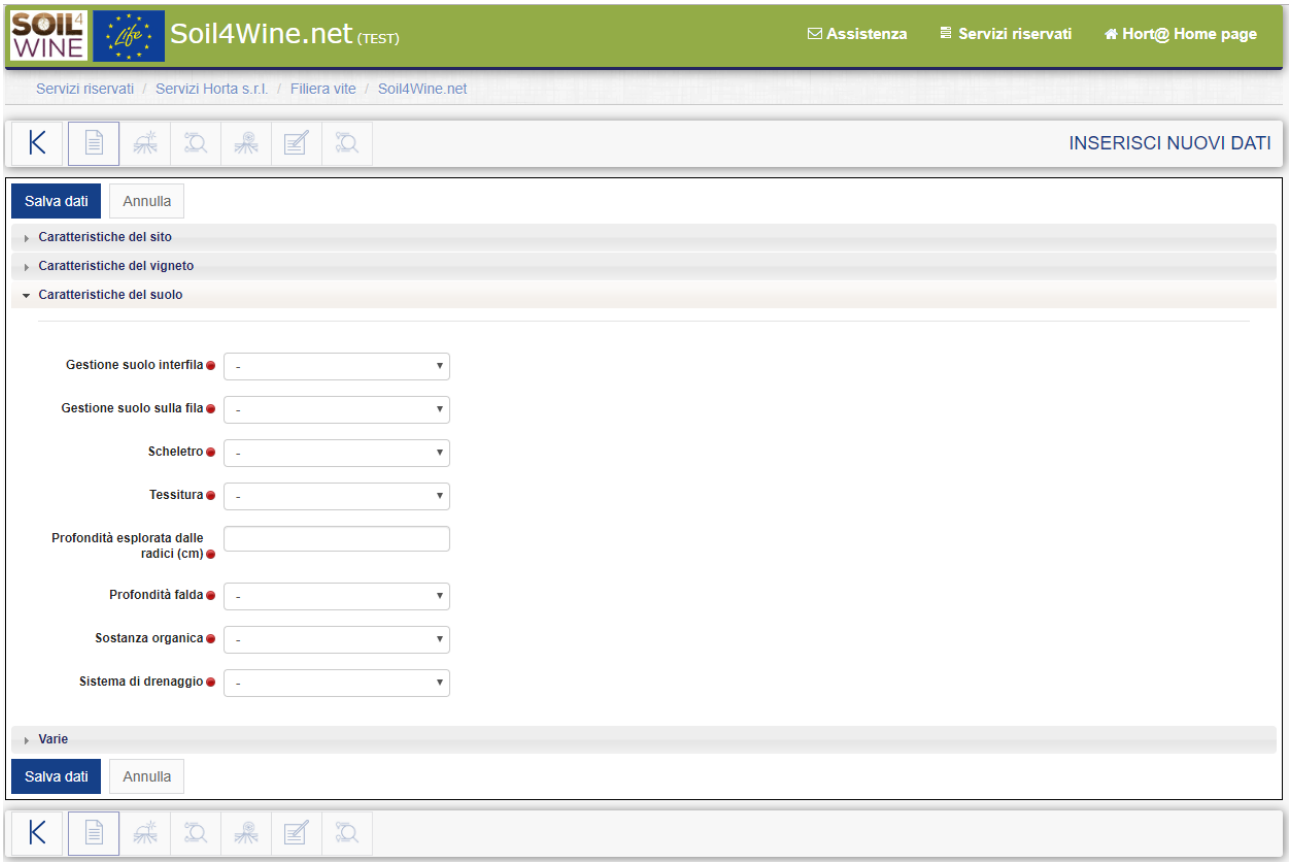


Figure 2.4 – Snapshot of the user interface to input data about soil characteristics

Other (Figure 2.5):

- Total rainfall (mm/year)
- Rainfall during grapevine growing season
- Planting operation
- Planting operation depth
- Soil tillage
- Number of tractor's traffic
- Organic fertilization (number/year)
- Mineral fertilization (number/year)
- Treatments with Plant protection products
- Degree days during growing season

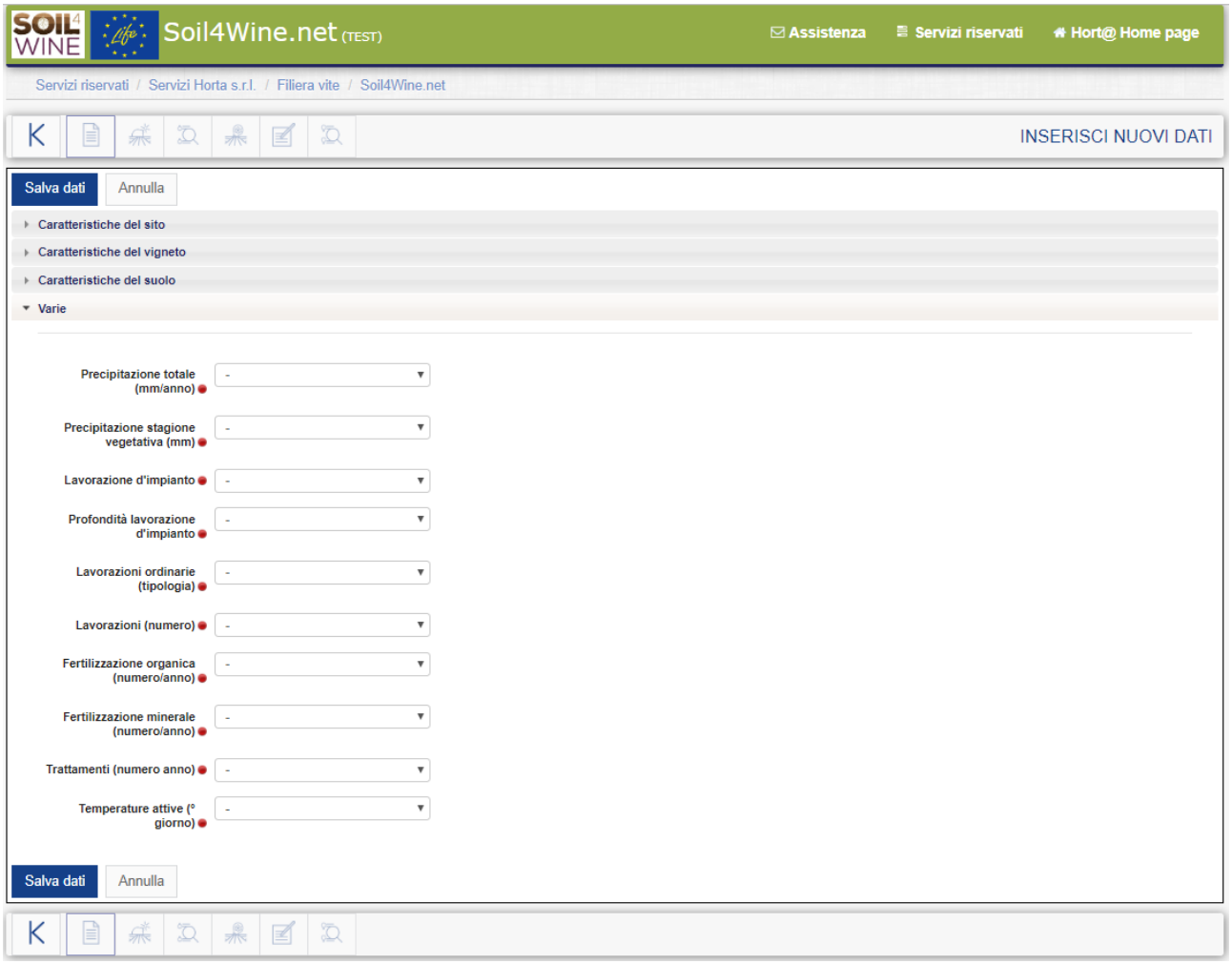


Figure 2.5 – Snapshot of the user interface to input "other" data

Once the data inputted are saved a new "Crop Unit (CU)" is created and it appears in the "list of crop unit page" (Figure 2.6). To check data inputted the user can click on the icon and visualize the details of the CU.

Figure 2.6 – Snapshot of the "crop unit page" with the list of the crop units created by the user

b. Potential soil threats

For each of the above-mentioned CU attributes a score is assigned related to the impact of the factor itself on the different soil threats. The computing engine then cumulates the different scores and provides an index of the potential risk of the different soil threats in the specific CU (Figure 2.7). These are available by clicking the icon . Colors were chosen based on the "traffic light" concept: green low potential risk, yellow and orange medium potential risk, red high potential risk.

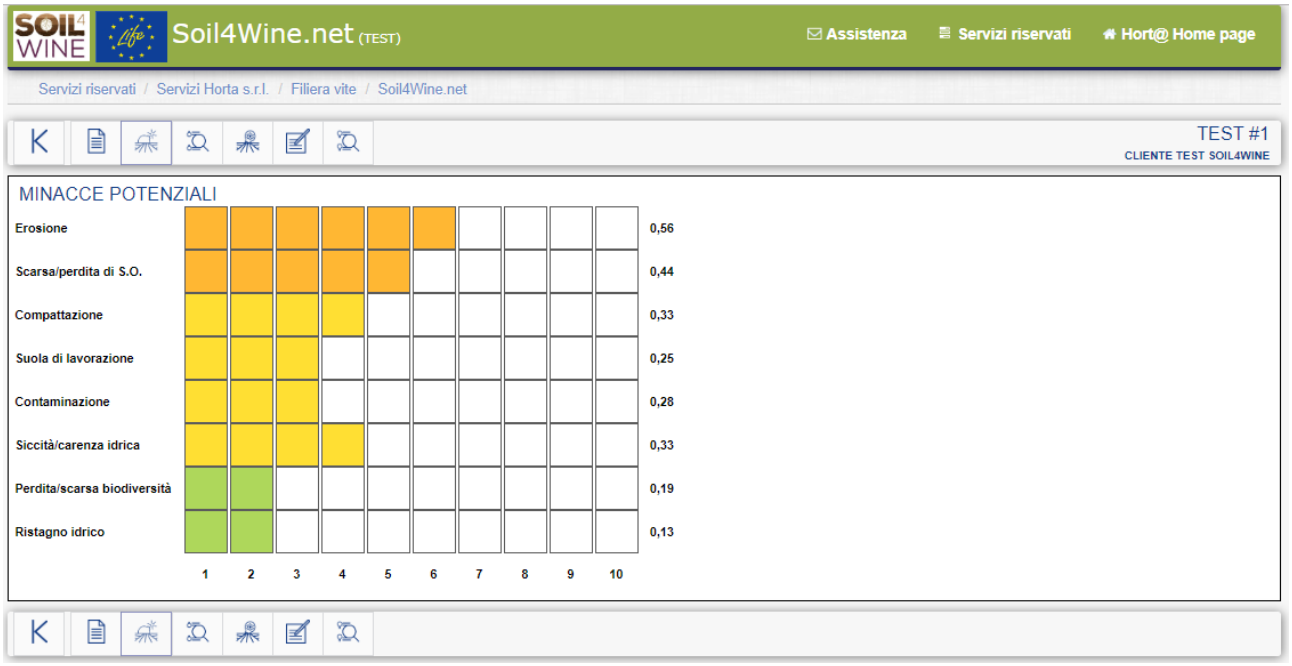


Figure 2.7 – Snapshot of the "Potential soil threats" page in which the indexes of the potential risk of the different soil threats in a specific CU are showed. Green low potential risk, yellow and orange medium potential risk, red high potential risk.

c. Check of the potential soil threats

Once the potential threats for a specific site are defined, the user has to check whether those threats are potential or real, by using specific indicators for each threat.

By clicking on the icon the page "Check of the potential soil threats" opens (Figure 2.8), the user can choose which soil threat he wants to check (by checking the box on the side) and by clicking the button "verify" the window with the specific checklist appears.

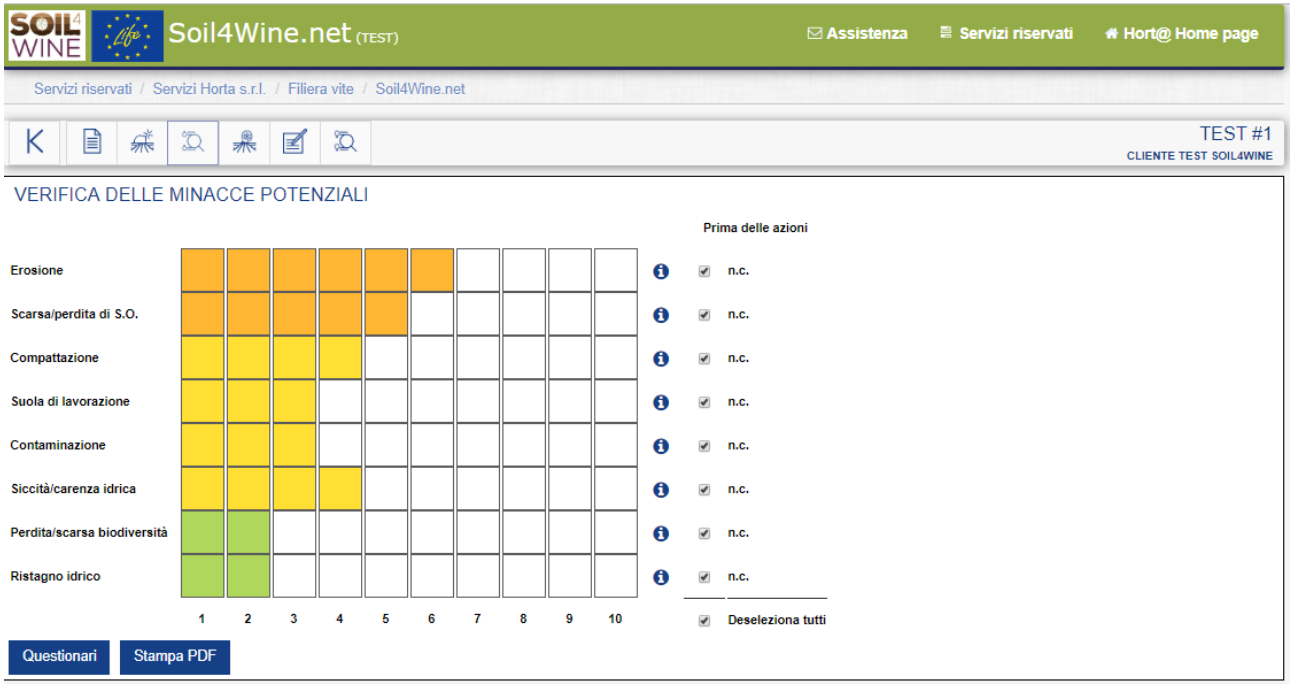


Figure 2.8 – Snapshot of the "Check of the potential soil threats" page in which the user chooses the soil threats he wants to verify in vineyard.

For each soil threat a "monitoring protocol" was prepared and is available for the download (as pdf file, by clicking the icon ℹ) and a specific window for inputting the observation data, collected by performing the described monitoring activities, was developed (Figure 2.9 to 2.16).

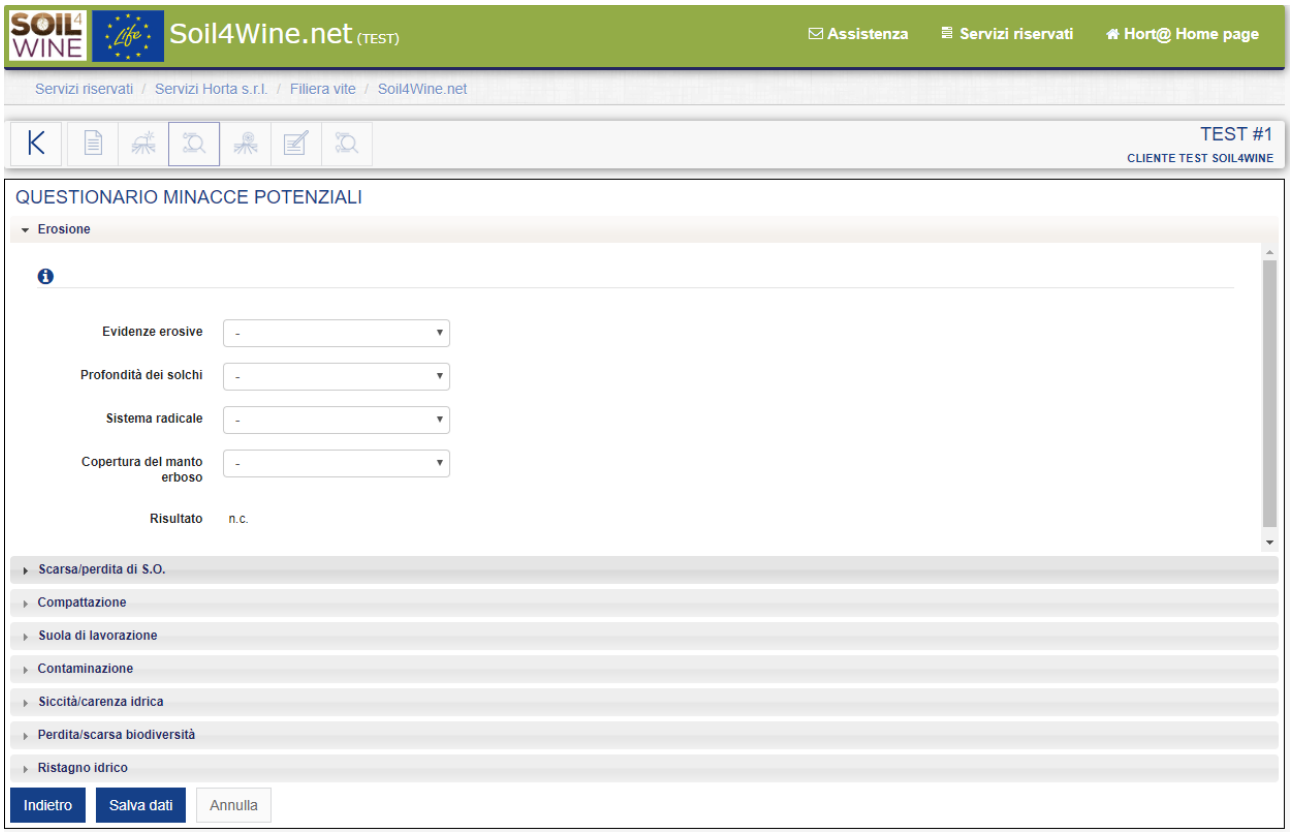


Figure 2.9 – Snapshot of the window for the inputting of the observation data on EROSION

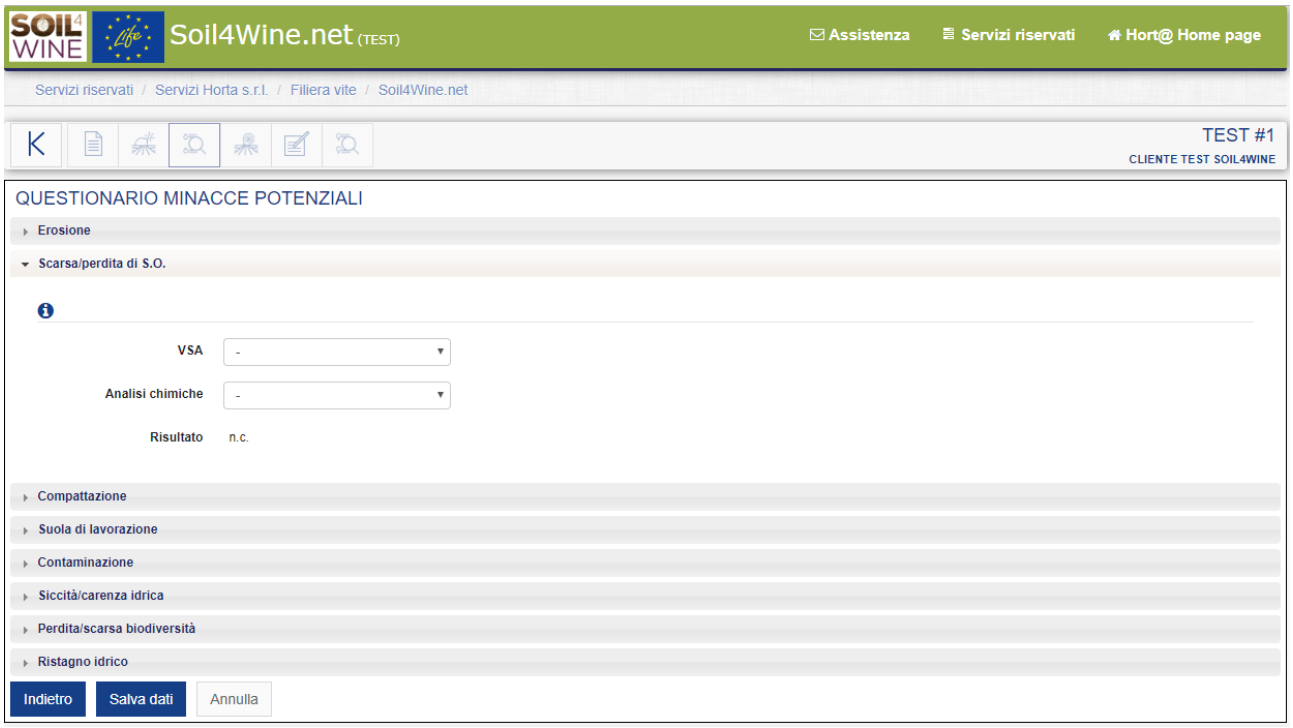
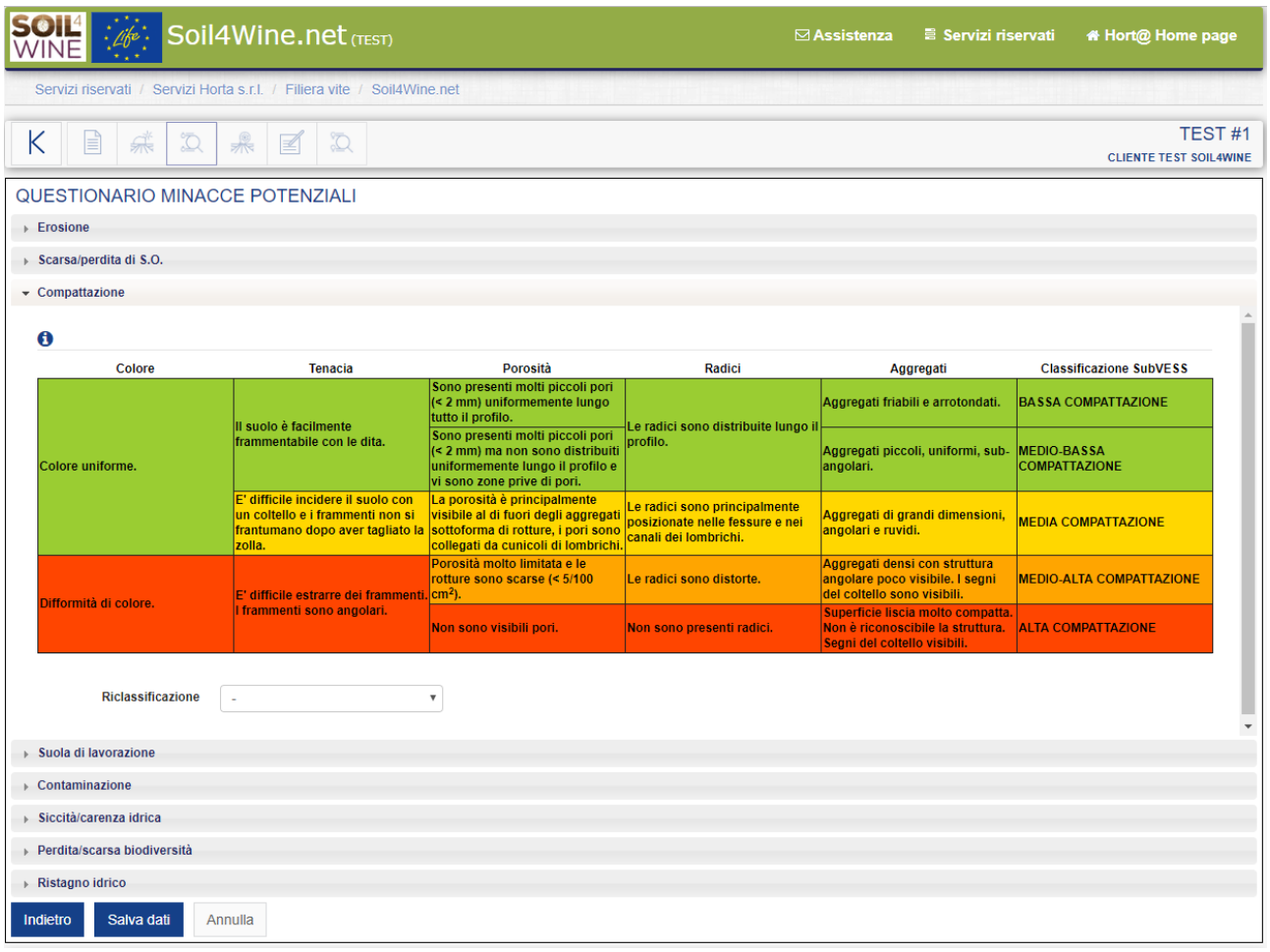


Figure 2.10 – Snapshot of the window for the inputting of the observation data on SOIL ORGANIC MATTER



Colore	Tenacia	Porosità	Radici	Aggregati	Classificazione SubVESS
Colore uniforme.	Il suolo è facilmente frammentabile con le dita.	Sono presenti molti piccoli pori (< 2 mm) uniformemente lungo tutto il profilo.	Le radici sono distribuite lungo il profilo.	Aggregati friabili e arrotondati.	BASSA COMPATTAZIONE
		Sono presenti molti piccoli pori (< 2 mm) ma non sono distribuiti uniformemente lungo il profilo e vi sono zone prive di pori.		Aggregati piccoli, uniformi, sub-angolari.	MEDIO-BASSA COMPATTAZIONE
	E' difficile incidere il suolo con un coltello e i frammenti non si frantumano dopo aver tagliato la zolla.	La porosità è principalmente visibile al di fuori degli aggregati sottoforma di rotture, i pori sono collegati da cunicoli di lombrichi.	Le radici sono principalmente posizionate nelle fessure e nei canali dei lombrichi.	Aggregati di grandi dimensioni, angolari e ruvidi.	MEDIA COMPATTAZIONE
Difformità di colore.	E' difficile estrarre dei frammenti. I frammenti sono angolari.	Porosità molto limitata e le rotture sono scarse (< 5/100 cm^2).	Le radici sono distorte.	Aggregati densi con struttura angolare poco visibile. I segni del coltello sono visibili.	MEDIO-ALTA COMPATTAZIONE
		Non sono visibili pori.	Non sono presenti radici.	Superficie liscia molto compatta. Non è riconoscibile la struttura. Segni del coltello visibili.	ALTA COMPATTAZIONE

Figure 2.11 – Snapshot of the window for the inputting of the observation data on COMPACTION

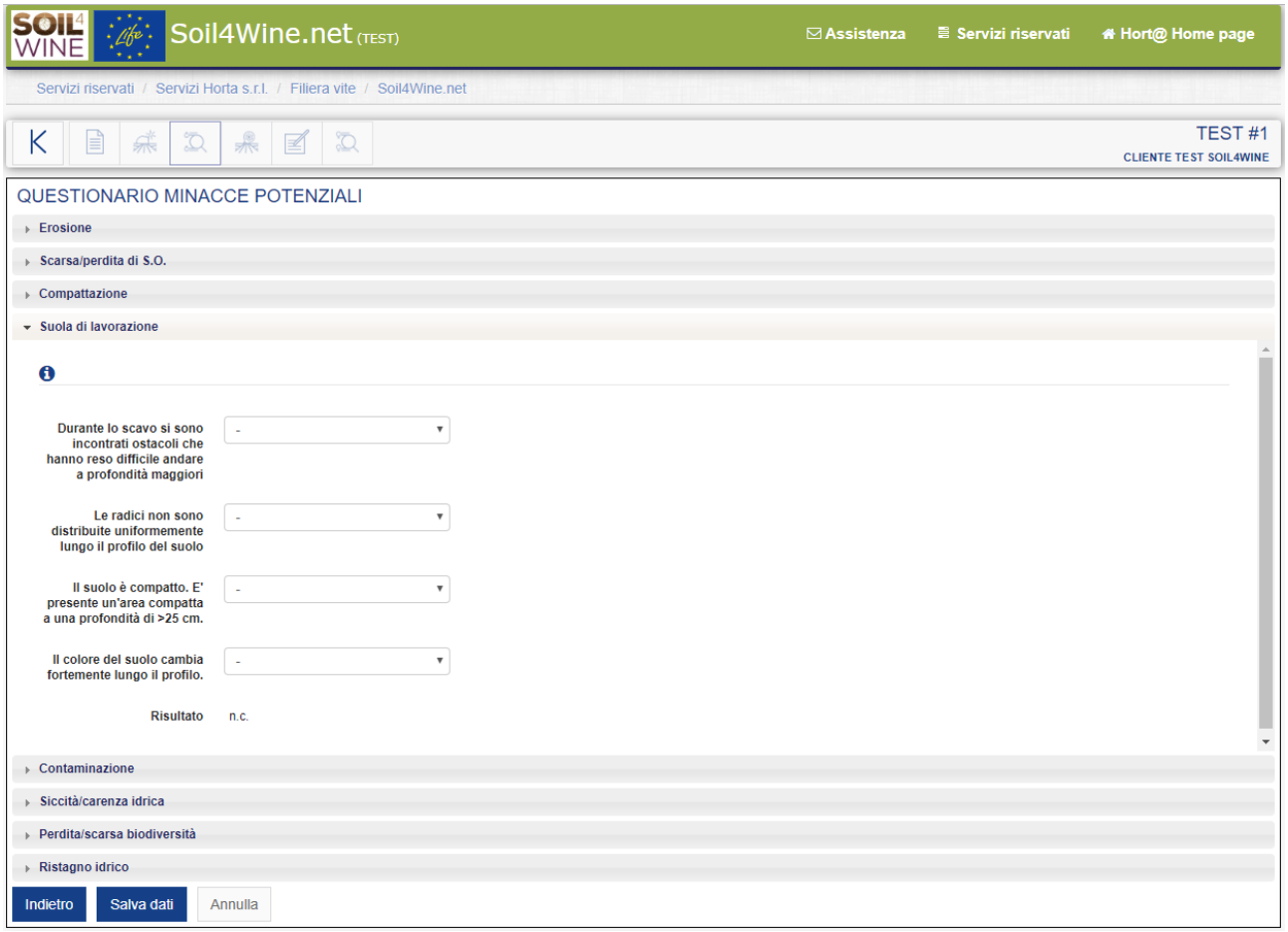


Figure 2.12 – Snapshot of the window for the inputting of the observation data on PRESENCE OF HARD PLAN

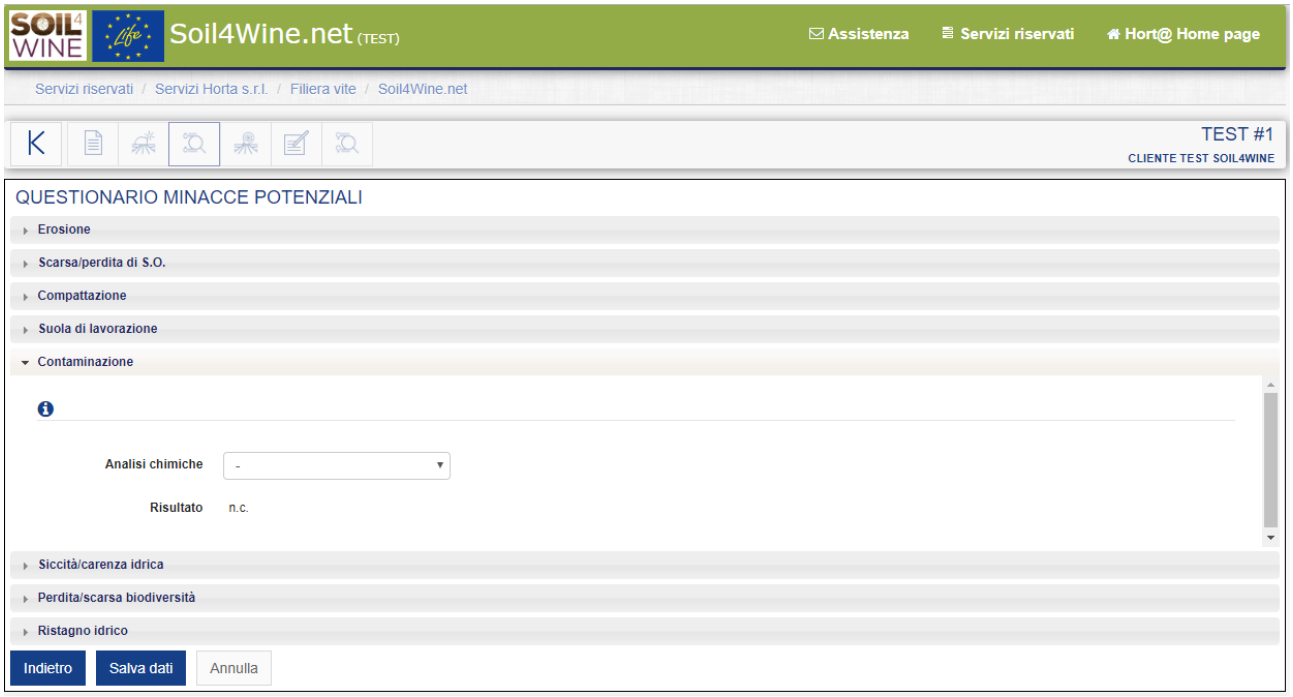


Figure 2.13 – Snapshot of the window for the inputting of the observation data on SOIL CONTAMINATION

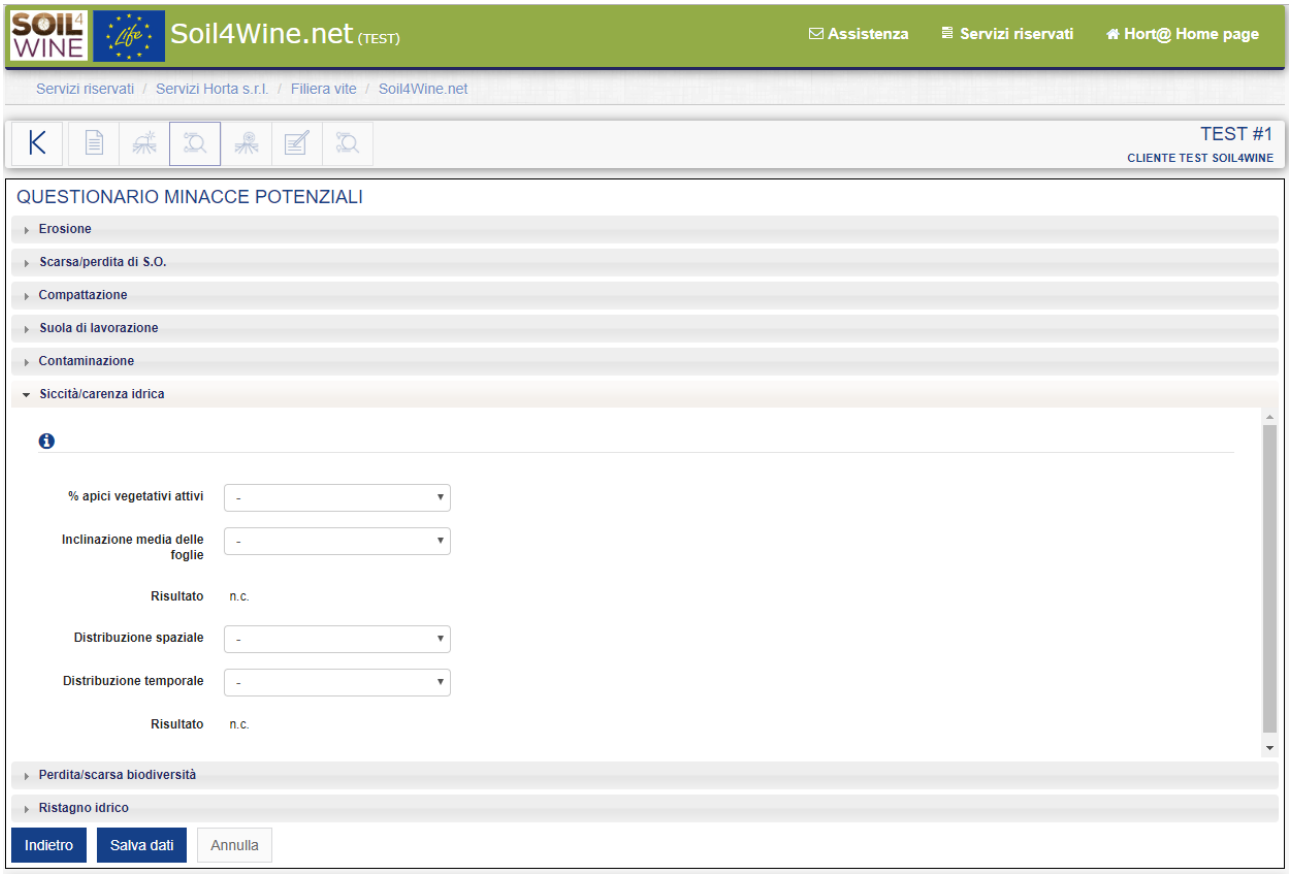


Figure 2.14 – Snapshot of the window for the inputting of the observation data on DROUGHT

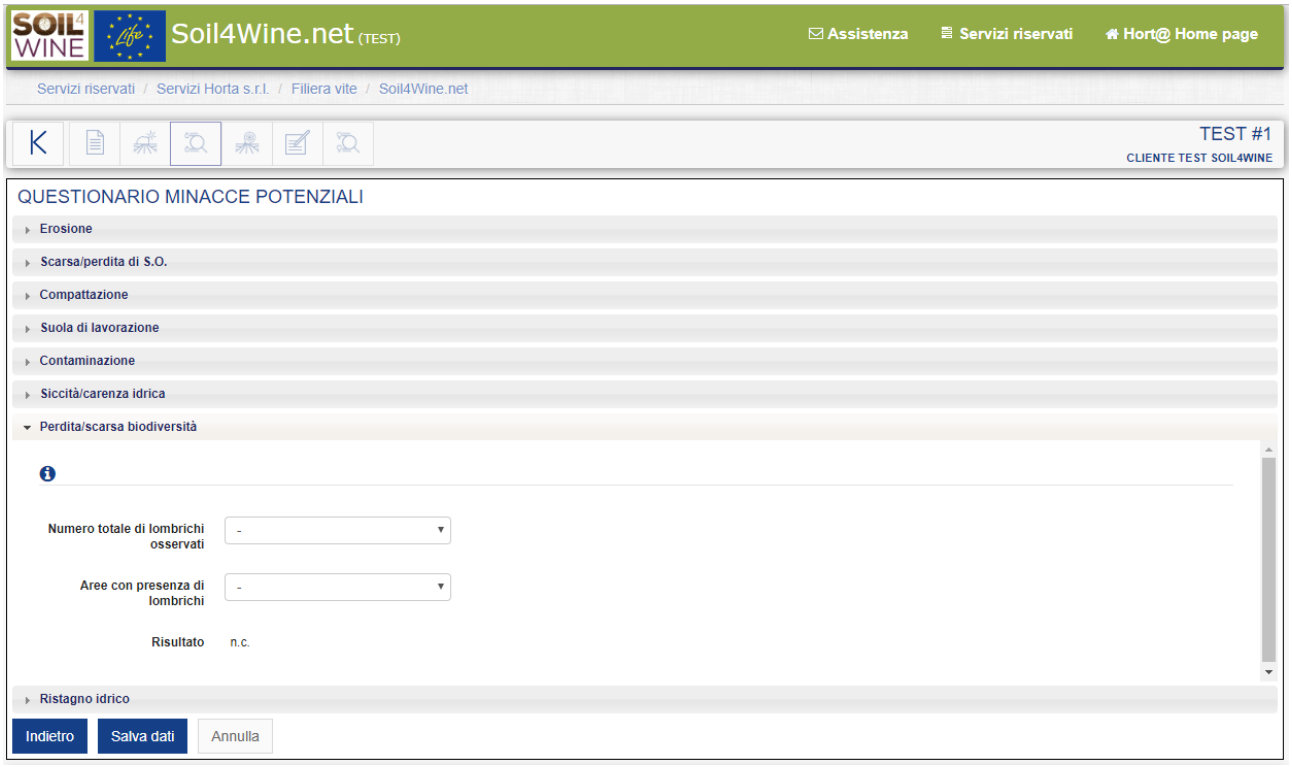


Figure 2.15 – Snapshot of the window for the inputting of the observation data on SOIL BIODIVERSITY

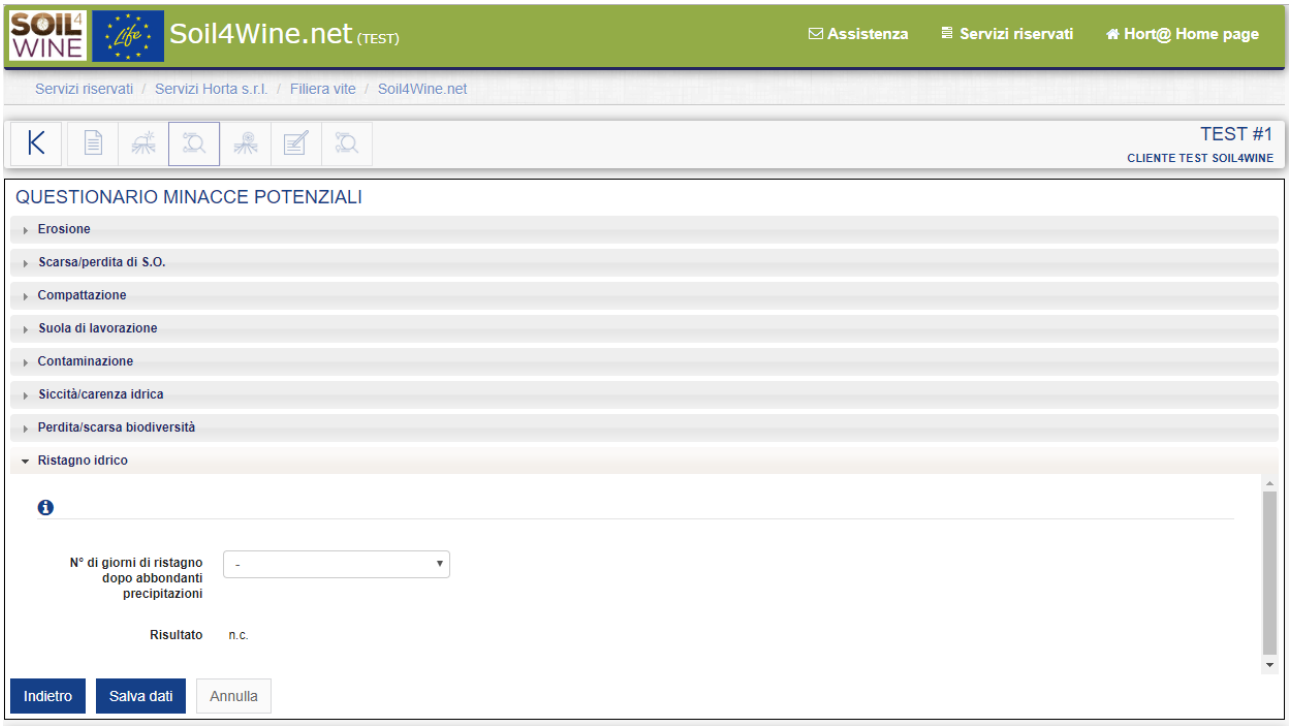


Figure 2.16 – Snapshot of the window for the inputting of the observation data on WATER LOGGING

d. Real soil threats

Based on the information inputted by the user about the different indicators related to the potential threats identified, the system confirms the threads and provides a list of real threats (Figure 2.17)

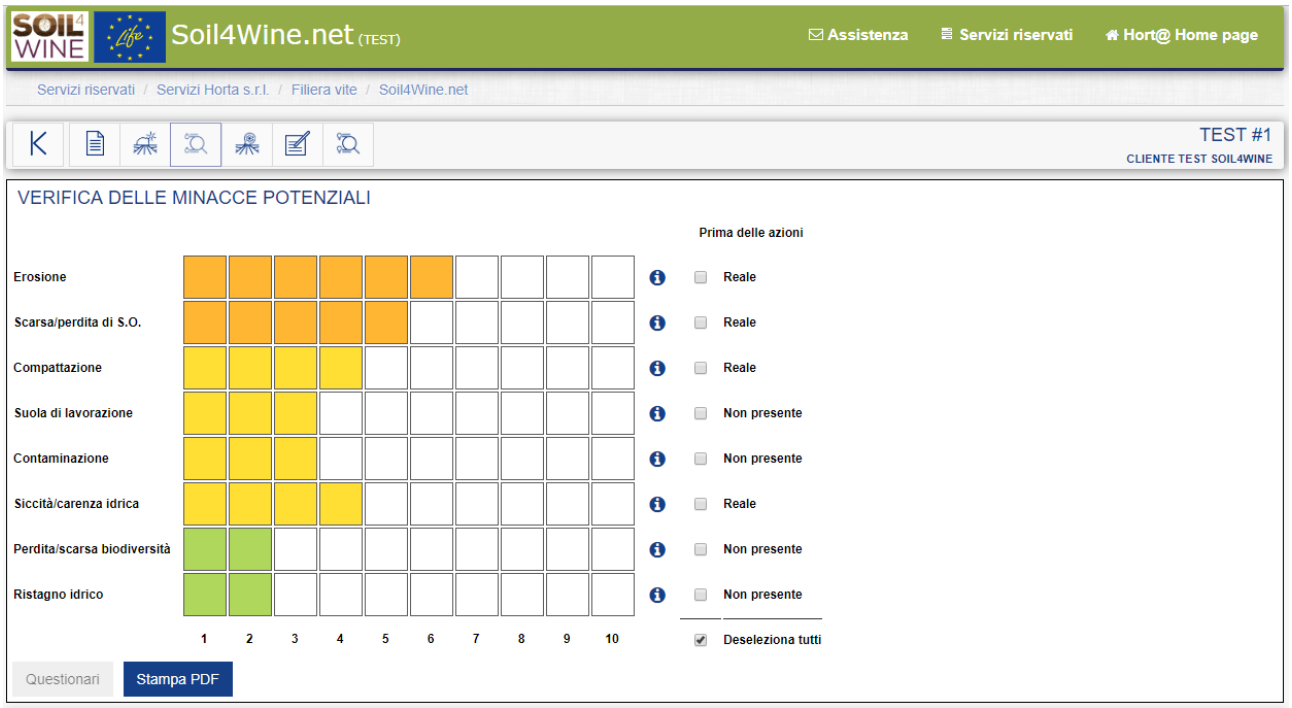


Figure 2.17 – Snapshot of the "Check of the potential soil threats" page in which threats are classified as "real" or "not present" based on the observation data inputted.

e. Possible solutions

By clicking on the icon possible solutions for the mitigation of soil threats are showed; the same solution can be implemented for several threats, therefore the efficacy of each solution for each threat is specified (Figure 2.18). A description of each solution, and the different activities to perform in vineyard to correctly implement the solution itself, is provided as downloadable pdf by clicking the icon ⓘ.

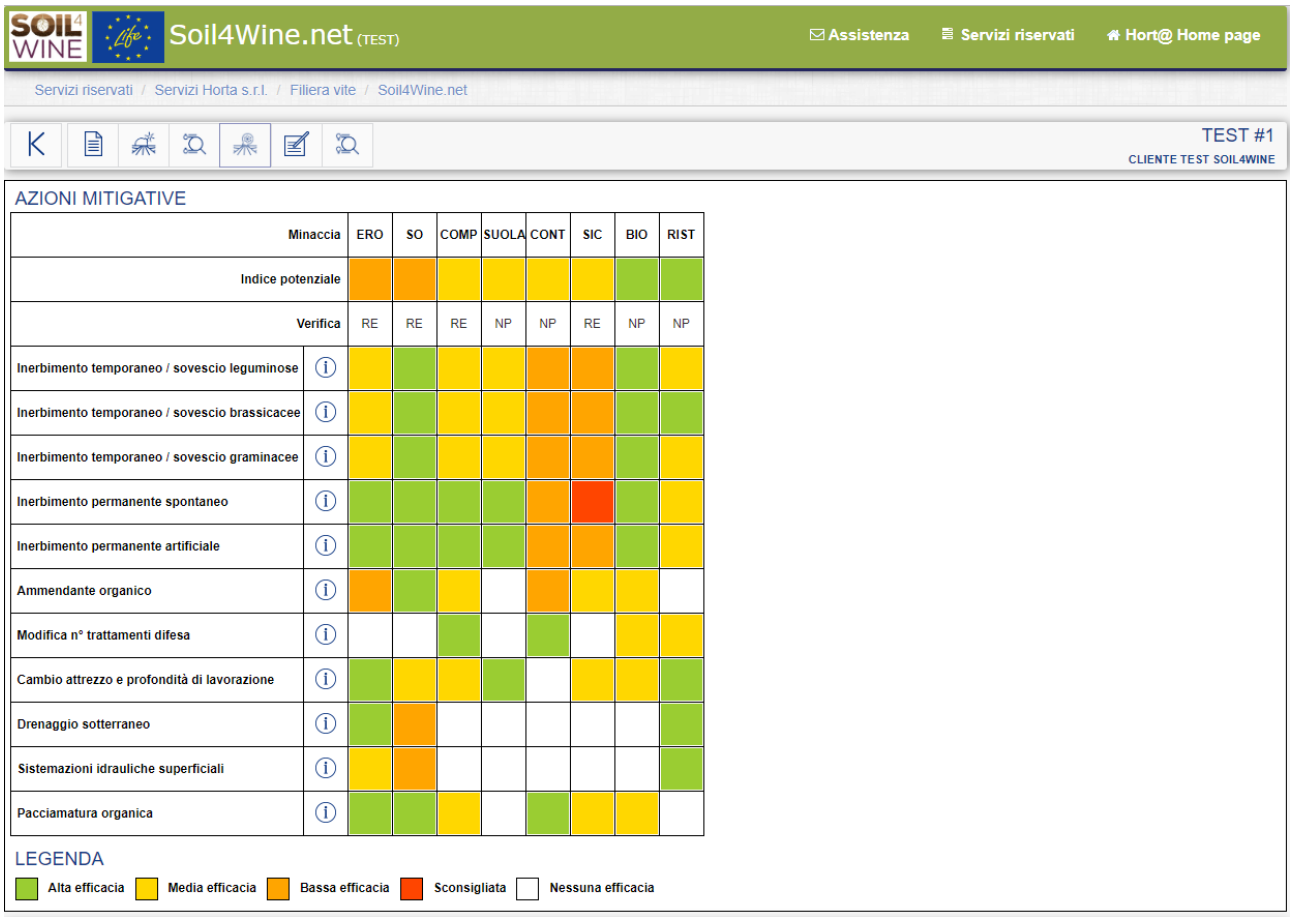


Figure 2.18 – Snapshot of the "Mitigation solutions" page, for each solution listed the specific efficacy against the different soil threats is provided with a color code (green= high efficacy, yellow= medium efficacy, orange= low efficacy, red= not recommended, white= no efficacy). For each solution a description is available as downloadable pdf by cliking the icon on the right of the solution name.

f. Register of soil threats mitigation actions

Once the user has decided which solution he wants to implement he can start the registration of activities performed in vineyard by clicking the icon (Figure 2.19). For some actions (such as temporary grassing with cover crops) a check whether the mitigation action was implemented successfully in vineyard is requested and the user is guided in the compilation of a questionnaire (Figure 2.20) and a monitoring protocol is provided as downloadable pdf.

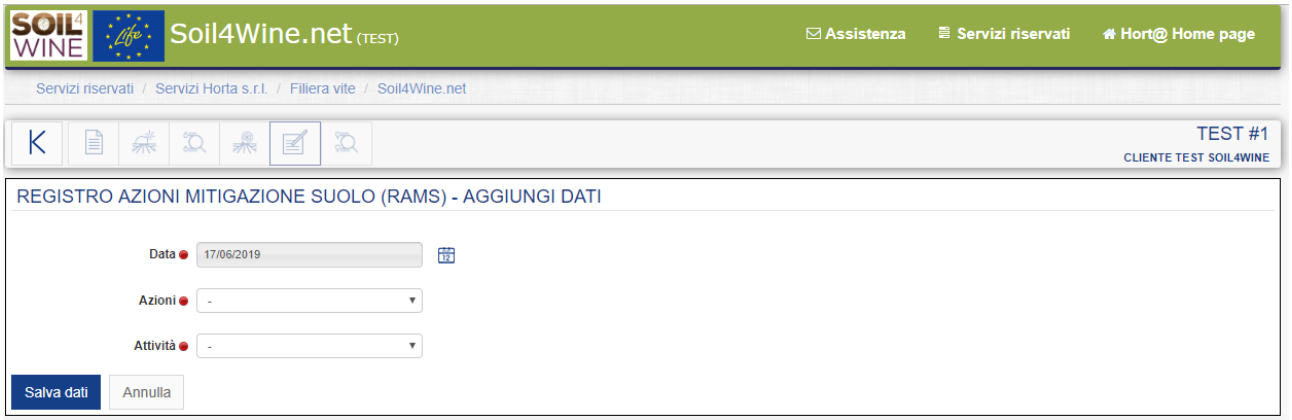


Figure 2.19 – Snapshot of the "Register of soil threats mitigation actions" page in which the user has to input all data about the activities performed in vineyard to implement the mitigation solutions.

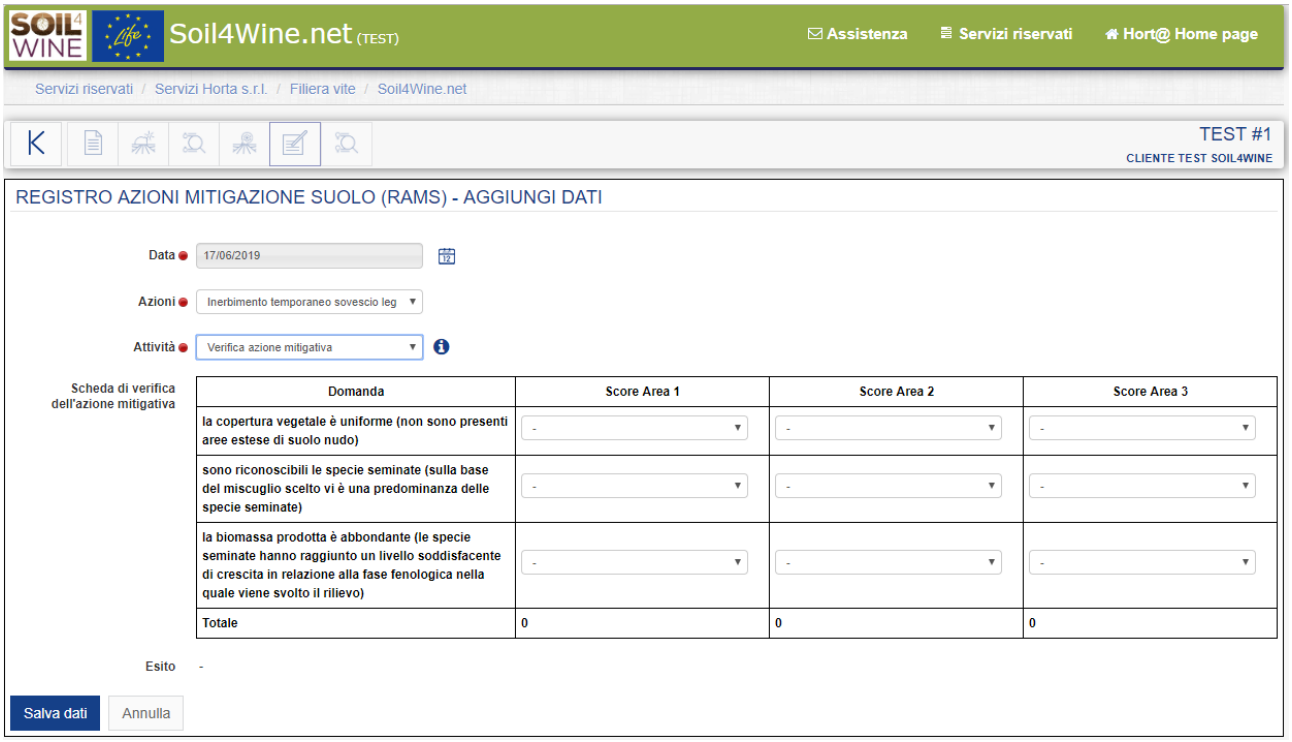


Figure 2.20 – Snapshot of the "Register of soil threats mitigation actions" page and the specific data input window for the check of successful implementation the mitigation solution: temporary grassing with cover crops.

g. Check of soil threats after implementation of mitigation solutions

Once the user has completed all the activities requested for the correct implementation of the chosen mitigation solution in vineyard (this can last several years), he needs to perform monitoring activities to compare the situation about soil threats before and after solution implementation. By clicking the icon the page "Check of soil threats after implementation of mitigation solutions" opens; in this page the user has to select the soil threats he wants to check in vineyard and by clicking the button "questionnaire" the inputting of observation data window will open.

Once the data are saved in the page "Check of soil threats after implementation of mitigation solutions" threats are classified as "real" or "not present" based on the observation data inputted a comparison between the

classification before and after the mitigation solution implementation can be performed (Figure 2.21). If a soil threat was present at the beginning and is not present at the end (after the mitigation solution implementation) the user has reached his mitigation goal, if not a new evaluation of mitigation solution implementation should be performed.

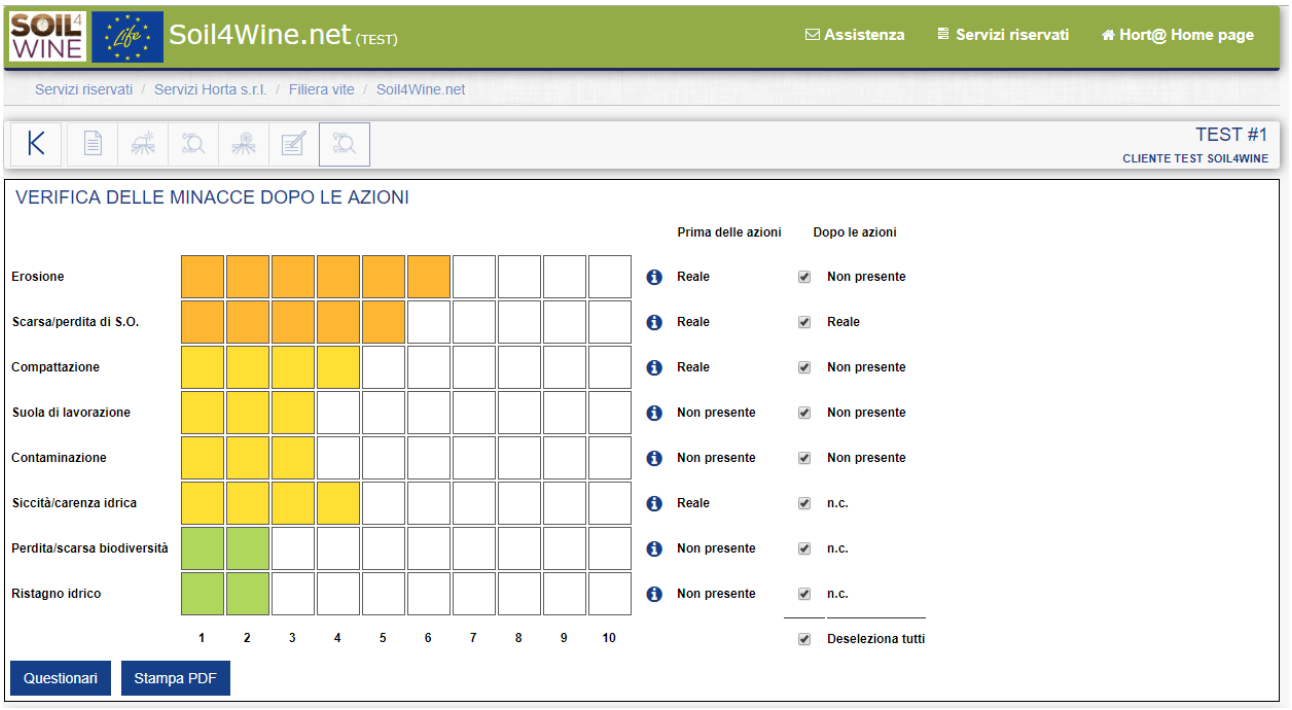


Figure 2.21 – Snapshot of the "Check of soil threats after implementation of mitigation solutions" page

3. Further developments

During Summer 2019 the beta version will be presented through several events and will be tested by "living labs" in the project area and across EU as foreseen in Sub-action 3.4 and 3.5.