



Implementation of epidemiological models for downy and powdery mildew in a DSS for integrated vineyard management

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MoDeM_IVM



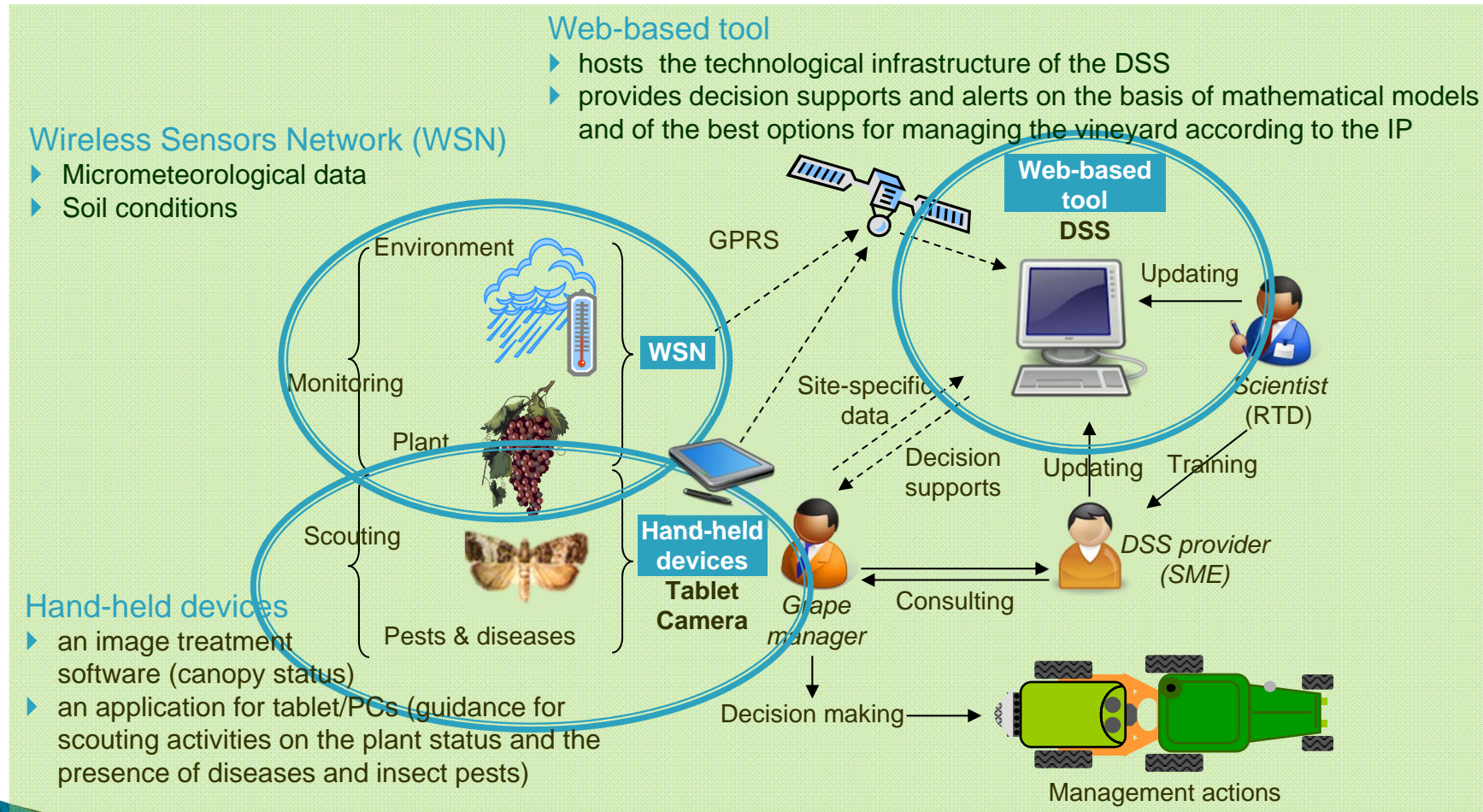
Monitoring and Decision Making for Integrated Vineyard Management

- ▶ **AIM:** Development of an interactive, web-based Decision Support System (DSS) for integrated management of the vineyard





MoDeM_IVM innovative approach





MoDeM_IVM: innovative approach

- ▶ Designed as a tool (does not replace the decision maker)
- ▶ Web based [available 7 days/7, 24 hrs/24]
- ▶ Continuous flow of information from the vineyard to the DSS
- ▶ Holistic vision of grape cultivation problems
- ▶ User-friendly interface
- ▶ Involvement of potential final users

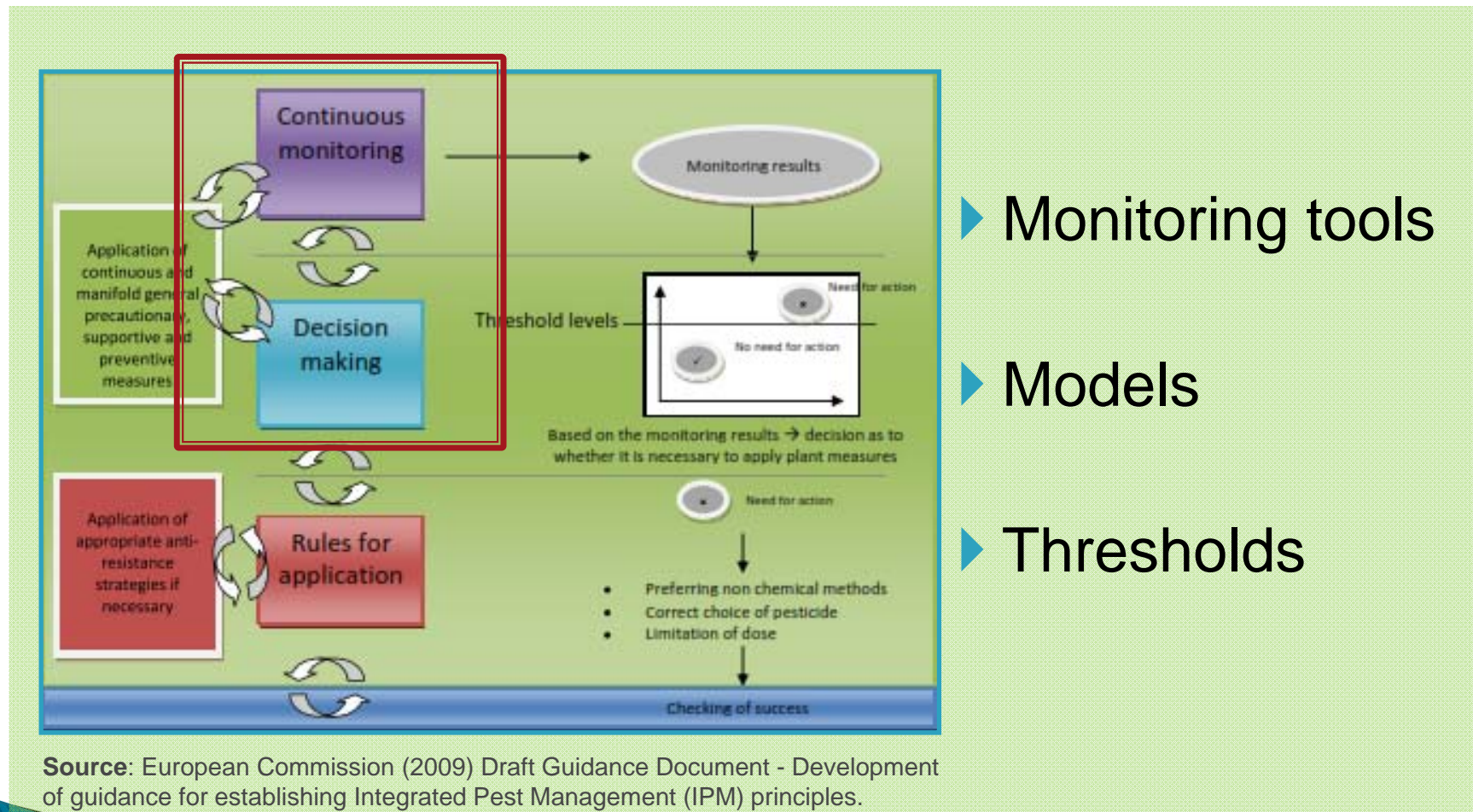


Eight general principles for IPM:

1. Measures for prevention and/or suppression of harmful organisms
2. Tools for monitoring
3. Threshold values as basis for decision-making
4. Non-chemical methods to be preferred
5. Target-specificity and minimization of side effects
6. Reduction of use to necessary levels
7. Application of anti-resistance strategies
8. Records, monitoring, documentation and check of success



Framework for IPM



▶ Monitoring tools

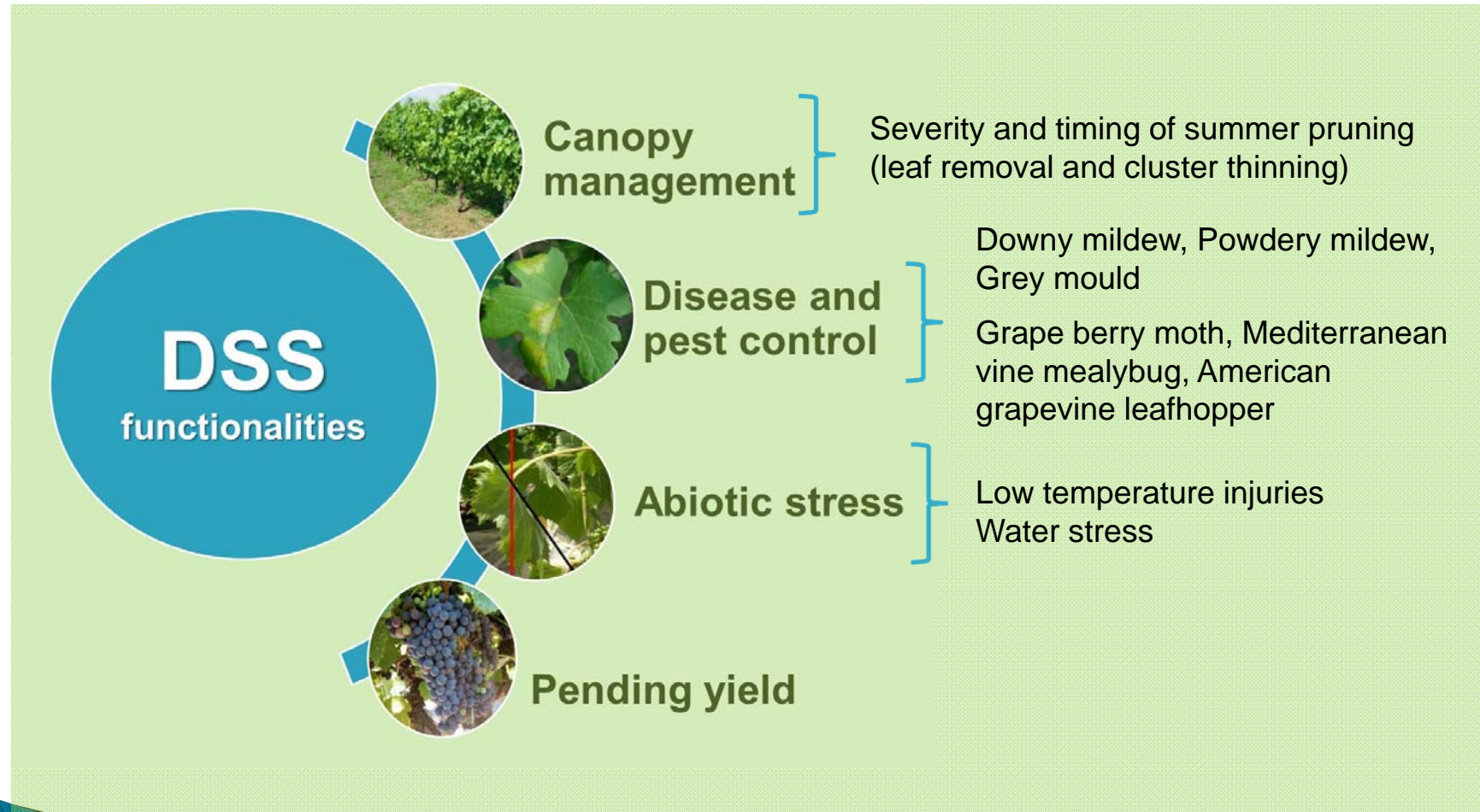
▶ Models

▶ Thresholds

Source: European Commission (2009) Draft Guidance Document - Development of guidance for establishing Integrated Pest Management (IPM) principles.



MoDeM_IVM: the DSS



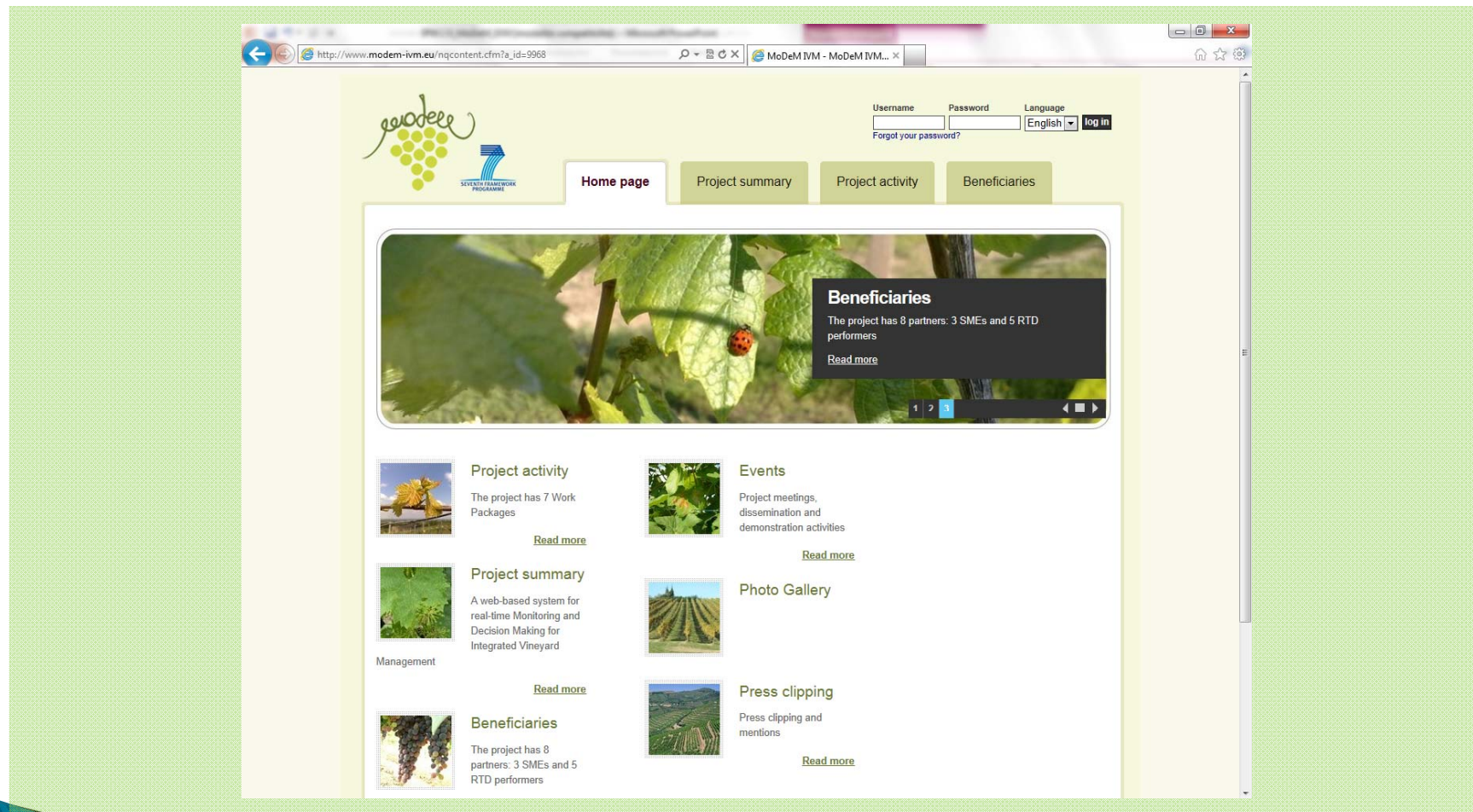


Decision supports and alerts

- ▶ Formulated on the basis of model output
 - ▶ The models working within the DSS receive weather and soil data in real-time by the WSN installed in the vineyard
 - ▶ The epidemiological and plant models were developed and validated at UCSC (published in peer-reviewed journals)
- ▶ Based on the best options for managing the vineyard according to the IP



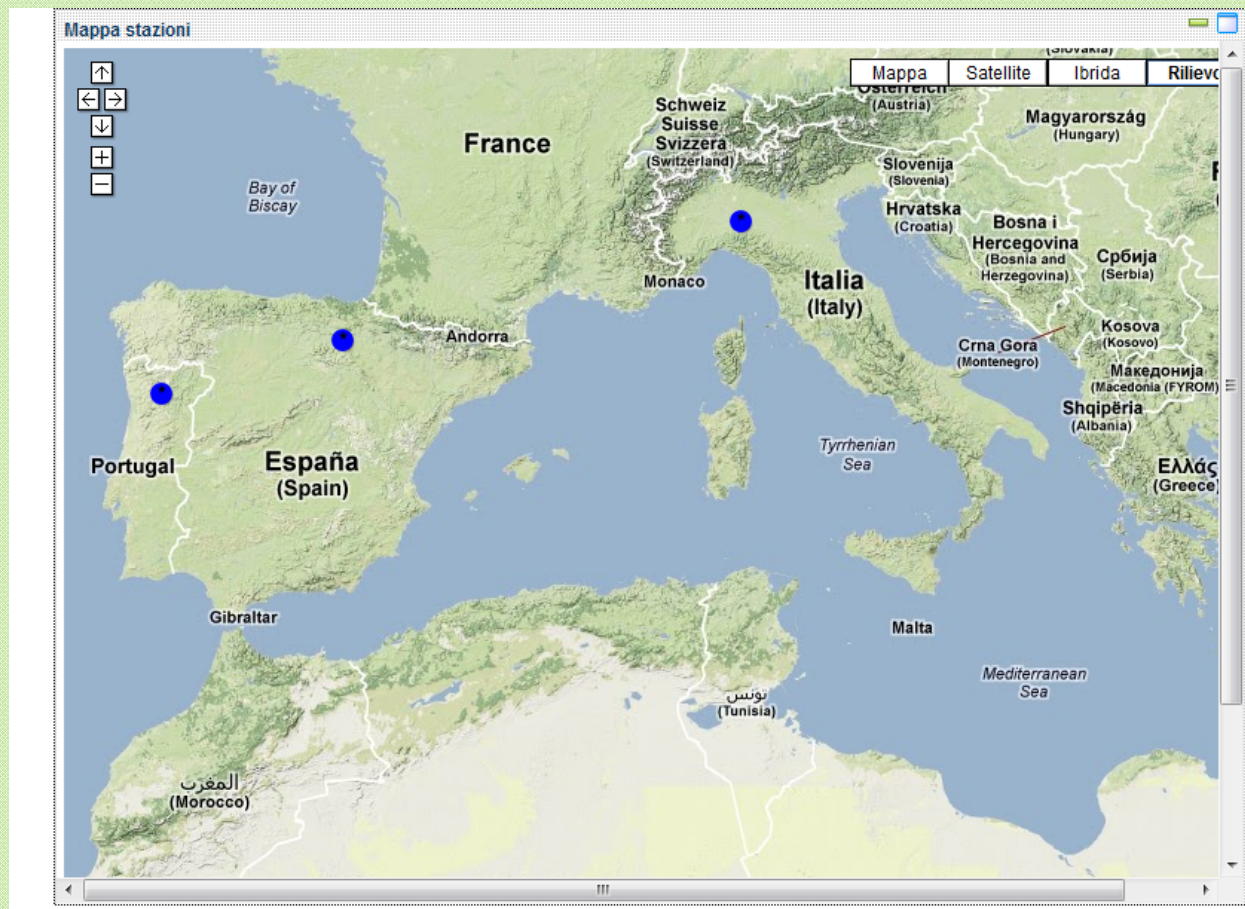
DSS access



www.modem-ivm.eu
info@modem-ivm.eu



Choice of the meteorological station





Crop Unit (CU) – definition

A vineyard grown:

- ▶ on an uniform piece of land (e.g., soil conditions)
- ▶ with the same variety
- ▶ with the same training system
- ▶ cropped in an uniform manner all season long



Crop Unit form

Ziano Piacentino (MoDeM) [New]

ZIANO PIACENTINO (MODEM) [NEW]

Site attributes

Customer : [dropdown]

CU Name : [text]

Company : [Search ... +]

Country : [dropdown] España

NUTS 1 : [text]

NUTS 2 : [text]

NUTS 3 : [text]

Latitude : [text] 44,98972

Longitude : [text] 9,39667

Elevation (m) : [text]

Average aspect : [dropdown]

Average slope : [dropdown]

Expire date : [text] 31-12-2012

Driving attributes

Grapevine Cultivar : [dropdown] Albana

Clone : [text]

Rootstock : [dropdown]

Training system : [dropdown]

Pruning type : [dropdown]

Distance between rows (m) : [text]

Distance between vines within the rows : [text]

Row orientation : [dropdown]

Average height of the canopy base (m) : [text] +

Average thickness of the canopy base (m) : [text] +

Canopy density : [Search ... +]

- ▶ Site attributes
- ▶ Vines attributes

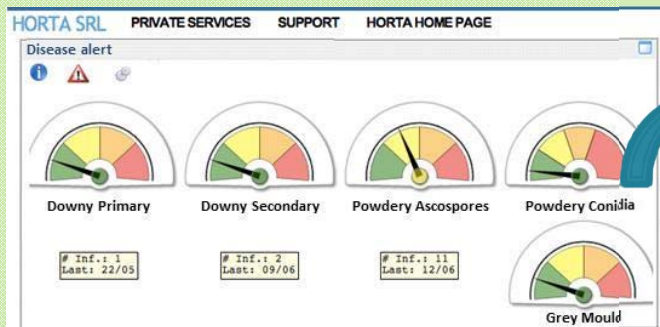


DSS dashboard





DSS: disease management support

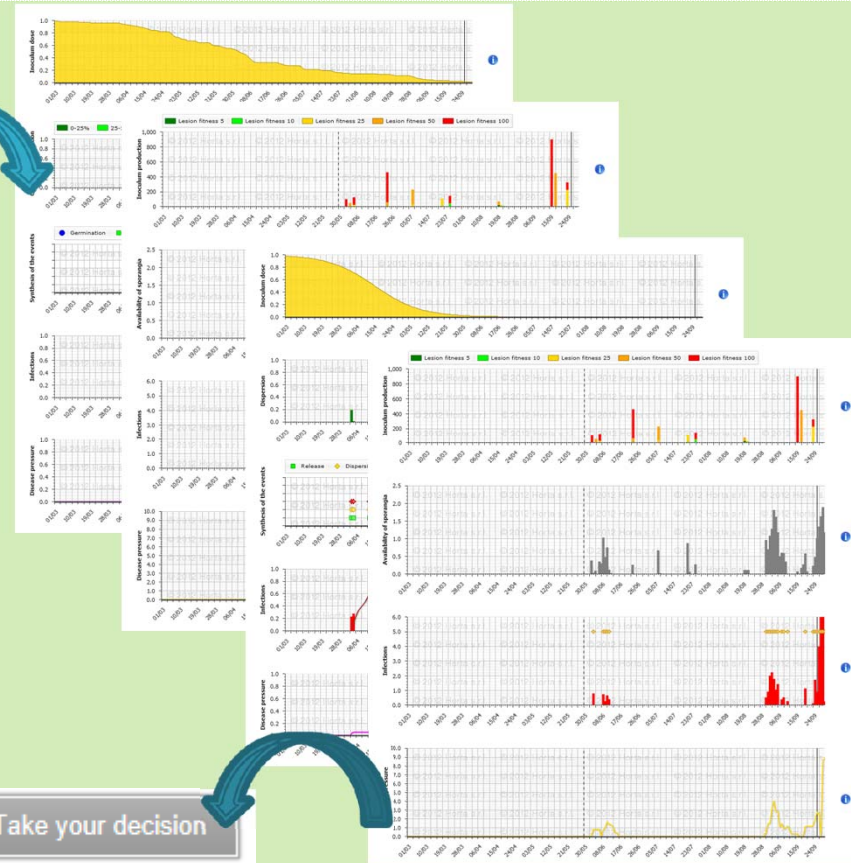


1. Synthetic information

Fuzzy-based
appropriateness
of fungicide spray

3. Support

Take your decision



2. Detailed information



Decision rules

- ▶ Plant phenology
- ▶ Residual fungicide protection
- ▶ Disease risk

Method: multi-criteria decision making based on
Fuzzy Sets Theory



Scouting

Downy Mildew

PRESENCE OF LESIONS

- ▶ No
- ▶ Yes, without sporulation
- ▶ Yes, with sporulation

Powdery Mildew

PRESENCE OF ASCOSPORIC LESIONS

- ▶ No
- ▶ Yes

PRESENCE OF CLEISTOTHECIA

- ▶ No
- ▶ Yes, yellow bodies
- ▶ Yes, brown bodies
- ▶ Yes, black bodies

ORTA SRL SERVIZI RISERVATI ASSISTENZA HORTA HOME PAGE

Ziano Piacentino (MoDeM)

Scouting (New)

ID : -

Date : 26-9-2012 19 : 15

Growth stages : Bud burst

Number of unfolded leaves : 1

Visibility of bunches : Search ...

Leaf area/bunch ratio : appropriate (1-1.5 am/kg)

Assessment of the water stress: Active vegetative apices : 0%

Assessment of the water stress : Normal

Stress characteristics: Extension : All over the crop unit

Stress characteristics: Period : Around noon only

Diseases - Downy mildew: Presence of lesions : No

Diseases - Powdery mildew: Presence of ascosporic lesions : No, Yes, without sporulation, Yes, with sporulation

Diseases - Powdery mildew: Presence of spherical fruiting bodies :

Close

The system works with no scouting data. Scouting increases the system's performance



Seminars with end-users

Participatory action research:

▶ insight on users' decision making process and criteria adopted to define the need of acting

▶ assessment of the willingness of adopting a DSS



MoDeM_IVM
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Research for LIFE17-IPM-0010-1

Survey questionnaire to the potential end users

PART I – Vineyard management

GENERAL QUESTIONS

◆ In which area do you work (province)? _____

◆ You are

- Advisor
- Grape grower

◆ (FOR THE ADVISORS) Indicate:

- The number of farmers you advise: _____
- The total vineyard surface (ha): _____

◆ Do you have any experience in using Decision Support

- Yes
- No

◆ If yes, indicate the crop and the name of the DSS

- Grapevine Name of the DSS: _____
- Other crop: _____
- Other crop: _____

MoDeM_IVM Question

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Survey questionnaire to the potential end users

PART II – Evaluation of the DSS developed in MoDeM_IVM

◆ Indicate, over a scale of values ranging from 1 to 5, (1 = not much, 5 = very):

- How much would you be interested in using the DSS?
- How much would you be inclined to use the scouting tool?
- How much would you be inclined in taking pictures for the estimate of the plant status?

◆ In respect to the meteorological data which feed the DSS, how would you like to receive them?

- As an integrated service of the DSS
- From a meteorological station of your property /of property of the farm you advise
- From the nearest public weather station

◆ Evaluate the easiness of interpretation of the DSS outputs, over a scale of values ranging from 1 to 5 (1 = very difficult, 5 = very easy):

DESIGN SUPPORT FOR CANOPY MANAGEMENT

- Leaf removal
- Cluster thinning

MoDeM_IVM Questionnaire – Part II 1/2



In-vineyard demonstration

- ▶ Establishment of DSS practical impact and market credentials
- ▶ seminars and visits to demonstration vineyards



plot managed according to
the vine manager's usual practice
VS

plot managed considering
the decision supports





Benefits for the users

- ▶ Implementation of the IP principles:
 - ▶ maintenance of the natural resources for future grape production
 - ▶ better use of resources (i.e., soil, water, biodiversity, etc)
 - ▶ rational use of plant protection products

- ▶ Providing criteria for justifying actions



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