"Leaf wetness duration: analysis of the agrometeorological requirements and evaluation of new estimation methods"

Florence (I) 21 and 22 March 2002

Participants:

Mr Andrea CICOGNA, ITALY
Ms Andreja SUŠNIK, SLOVENIA
Ms Anna DALLA MARTA, ITALY
Mr Antonello COSSU, ITALY
Mr Marco GANI, ITALY
Ms Mariangela SANDRA, ITALY
Mr Matteo DE VINCENZI, ITALY
Mr Maurizio SEVERINI, ITALY
Mr Robert OGER, BELGIUM
Ms Roberta ALILLA, ITALY
Mr Simone ORLANDINI, ITALY
Mr Spyros KOTSOPOULOS, GREECE
Mr Stefano DIETRICH, ITALY

1) Presentation of the meeting and approval of agenda **(Stefano Dietrich and Simone Orlandini)**

2) Personal presentation

All the participants introduced their activity and experience in this field.

3) Researches presentation

Marco Gani - Considerations between precipitation maps of the radar and measured LWD
The comparison between the precipitation maps of the radar and the LWD data measured by a network of 14 stations in the plane of Friuli-Venezia Giulia demonstrates that the radar can be a good mean to estimate the LWD in rain condition and it can be very interesting to obtain a spatial integration of the data measured on the ground and for the optimisation of the net density.

Andreja Sušnik - Sensors problems and application of DROPBEN model
A physical model, DROPBEN, has been used for the simulation of LWD. Then, the measurements and the simulated data were compared for the same period of time. The result demonstrates that there is a wide difference between simulation and observation of LWD duration. This is probably due to the low efficiency of LWD sensors, as demonstrated by previous researches.

Anna Dalla Marta - Comparison of different methods of LWD estimation
For the estimation of LWD three types of methods have been tested: DROPBEN, SWEB and ARTIFICIAL NEURAL NETWORKS. All these methods, based on meteorological data, lead to an overestimation of LWD in comparison to the sensor measurements. The results have

been used, then, as an input for an epidemiological model, PERO, developed to calculate the *Plasmopara viticola* infection start and further development in grapevine. The overestimation of calculated LWD, as expected, has repercussion on the disease simulation.

Antonello Cossu - The SAR activities
SAR has got a network of 54 meteorological stations all over the Sardinia territory and its activities include plant protection. SAR is interested in simulating *Plasmopora* epidemics and the model EPI has been used. To optimise the results of the model, the LWD data should be used as input.

Maurizio Severini - A new model for the energy balance
As the LWD due to dew depends on the energy balance and heat flux, a new model will be developed to calculate these quantities, taking in consideration the stability of the atmosphere. The net radiation is requested for the model, for now it is estimated with Brunt's formula but considering the importance of this information it is desirable to have in future the availability of a net radiometer for direct measurements. If the measured net radiation is available the others input required are wind speed, air temperature at two levels and the soil flux. Otherwise, if the net radiation is estimated and not measured, there is the need of more parameters: the global radiation, air temperature at three levels, soil temperature at two levels, relative humidity and wind speed.

Robert Oger - LWD estimation from standard data and radar images
A physical model has been developed, based on Pedro and Gillespie researches, to detect the LWD using weather and radar data. From next July the model will be operational applied to asses the risk of wheat contamination with micotoxyne of Fusarium.

Spyros Kotsopoulos – Towards the prediction of the leaf wetness duration
In order to calculate LWD after a precipitation incident, the evaporation of water intercepted by the leaf canopy over a short period has to be estimated. It is reasonable that in such cases a combination of physical models, as that proposed by Penman-Monteith for evapotranspiration, should be applied. Additionally, generated weather data related to LWD for specific areas and periods of crop growth could be used to predict the expected extent and significance of LWD in such cases.

4) Main problems detected

A - The effective impact of LWD on grapevine diseases has to be clarified by a phytopatologists;
B - there is no standard for LWD measurement and the different types of sensors seem to have a reliability problem;
C - to use the models there is a need to establish an unambiguous threshold between dryness and wetness;
D - the models have to be calibrated to the specific climatic conditions;
E - to develop a new model for the energy balance and to optimise the efficiency of the existing simulation models the calculation or the measurement of net radiation is required;
F - to use the data collected by the radar is necessary to find out the right interpolation technique for all the input parameters.

5) The discussion led to the following decisions:

A - An international expert will be consulted to clarify the specific role of LWD on plant diseases.
B - To run the LWD estimation models three different datasets of weather and radar data, belonging from three different regions, will be used: Friuli Venezia Giulia (**Marco Gani** and **Andrea Cicogna**), Sardinia (**Antonello Cossu**) and Slovenia (**Andreja Sušnik**). A form will be distributed among the COST participant to collect information about other possible datasets of weather data.
C - The models which have to be studied for the LWD estimation are :
DROPBEN (**Andreja Sušnik, Simone Orlandini, Anna Dalla Marta**),
SWEB (**Andrea Cicogna, Simone Orlandini, Anna Dalla Marta**),
NEURAL NETWORKS (**Matteo De Vincenzi, Simone Orlandini, Anna Dalla Marta**),
Maurizio Severini will continue the study for the energy balance model, using different formulas for the net radiation calculation.
Robert Oger will continue the work on the new model using standard weather data and radar images.
D - To validate the models the different outputs will be compared and a sensibility analysis will be carried out.
To give homogeneity to the validation of the models a common type of analysis will be used.
It has been decided to adopt a threshold of 10 minutes between dryness and wetness.
E - The calculated leaf wetness will be used to run some epidemiological models, PERO, PLASMO (**Andreja Sušnik, Simone Orlandini, Anna Dalla Marta).** For the model ASCHORF, for apple scab epidemics simulation, the support of **WG 2 of COST718** will be requested.
F - The collaboration of **WG 1 of COST718** will be requested to evaluate the interpolation methods to be applied for the LWD input parameters requested by simulation models, also in order to integrate the data with radar measurements.

6) Report

All the papers presented during the expert meeting will be collected (**Simone Orlandini**, **Stefano Dietrich**), and the possibility of publishing a report on leaf wetness duration will be evaluated during next MCM of COST718.

7) Web site for interchanges

To favour and increase the communication among the participant to the meeting, a web site will be created and linked to the COST718 official web site (**Stefano Dietrich**). Presentations, papers, models, data, references, news will be put on the web site to allow a concrete and fast exchange of information.

8) Possibilities for a project

All the participants are invited to consider different possibilities to propose a project to support the research activity on this field. The information should be communicated to the other participants and put on the web site.

MODEL: DROPBEN
Origin: DWD, Germany

filled in by **COUNTRY-REGION-INSTITUTION:**_____
PERSON:_____

model input variables	**temporal resolution**	**units**	**measured (+) calculated (-) radar**	**calculation equation**	**spatial resolution (no. of station/ km^2)**
temperature	h	°C			
relative humidity	h	%			
precipitation	h	mm			
wind speed	h	m/s			
global radiation	h	W/m²			
longwave radiation	h	W/m²			
cloud cover	h	octas (only needed, if longwave radiation misses)			

Further comments:

MODEL: SWEB
Origin: Roger Magarey

filled in by **COUNTRY-REGION-INSTITUTION:**_____
PERSON:_____

model input variables	**temporal resolution (h)**	**units**	**measured (+) calculated (-) radar**	**calculation equation**	**spatial resolution (no. of station/ km^2)**
air temperature	h	°C			
relative humidity	h	%			
precipitation	h	mm			
wind speed	h	m/s			
net radiation above canopy	h	W/m²			
net radiation below canopy	h	W/m²			
cloud cover	h	%			

Further comments: