

# VINE DISEASES MODELLING : MAPPING OF EPIDEMIC RISKS AND FUNGICIDES SPRAYS OPTIMISATION

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**Marc RAYNAL, CITV Bordeaux**

Dealing progressively with integrated crop control management, french vinegrowers are now turning to a growing management based on a better control of treatments, reduction of chemical and alternative methods. However, in the vineyard, chemical pest control of cryptogamic fungi remains the most widely used. Spraying techniques and risk evaluation so necessarily need to be integrated to pest management to improve frequency of the treatments and quality of the sprays, in order to minimize their effects on the environment.

## *Anticipating epidemic risk and modeling diseases*

ITV France is willing to produce tools in order to help growers managing pests and diseases control. The diseases most frequently found in the French vineyard are downy mildew, powdery mildew and black rot. The models used in Bordeaux, Gaillac, Nîmes and Angers are the "Potentiel Systems" developed by S. Strizyk (SESMA). This analyzing risk method must lead to adjust the number of treatments to the risk and eventually decrease it.

The fundamental features of a predicting risk model, thus determining the level of its usefulness for the vine growers, are evaluation, description and prediction of risk :

- the model is asked to give a live analysis of the probability of an epidemic spreading risk. It indicates a contaminating potential which, as a matter of fact, is an absolute abstraction,
- combining this probable risk evaluation to the reality of contaminations defines the model ability to describe or even explain the current epidemic developpements,
- the forecast simulations based on meteorological broadcasts give different possible schemes of evolution of the disease.

Depending on the model strength, the models are more or less part of a disease control management. The simulations they give become part of a larger data bank including meteorological, agronomical and disease damage estimations datas. These informations lead the grower to final treatment decision, thanks to his technical advisors. Simulations are then used, according to the reliability of the models they come from, to develop experimental strategies first on experimental parcels and then on larger surfaces. Using these informations at a larger scale necessarily needs a permanent control of risks simulated by modelling and observed in the vineyard, in order to minimize damages in case of deviation, which allways remains possible : models are allways about to be unvalid.

The main support of the modelling project is based on untraeted network of vines, on which regular controls are done. These observations are both used to validate the models and treatment strategies developped along the season. They allow to build references usefull for

model improvement. When sent to the network partners all along the season, they allow the final user to appreciate the reliability of the given informations.

Modeling of vine diseases still remains a new approach. These tools need to be used carefully used and stay within clearly defined rules. The first recommendation given by ITV France is to work within a network : for the moment modeling forbids any local, lonely, and isolated use. The network organization assure, by the repetition of controls and observations, a much better spatial evaluation of the epidemic risks, and sometimes shows the diversity of the attacks. However it creates a great number of datas, whose constant exploitation turns out to be quite difficult. Geographic Information Systems (GIS) so is the appropriate tool to evaluate a local information within its global environment. Recent developpements of softwares allow us to show first results on epidemic behaviors of vine diseases (work done in relationship with CIVB).

Such a use of models allow to optimize strategies and to apply more preventive than curative treatments. They are now used in order to adapt the amount of chemical according to the evaluation of epidemic risk and the plant developpment.

#### *Agronomic optimization of spraying : Optidose*

In Bordeaux, ITV France works on this subject since almost ten years. The first experiments were led in order to measure the influence of spraying on the final efficacy of a treatment. The aim was to appreciate performances of the different available spraying systems and to define for each of them the optimum setting row which would result in the best efficiency. The question of the quantity of chemicals necessary to control the epidemics arose from the first results : Why, according to current practices and recommendations, do we apply full amounts of chemicals actually determined to fight against extremely severe disease, while epidemics may turn out to be weak or even non existent. Actually, what is a good treatment ?

Appreciation of the quality of a treatment stands as a compromise uneasy to find, and which is for now impossible to evaluate scientifically in the vineyard. Analyzing these difficulties to define what a good treatment is, progressively led us to to plan new fundamental working axes, in order to appreciate more objectively :

- **Where** does the spraying effectively goes, and what are the global sizes of the foliage's surfaces we're trying to protect by spraying ?
- **How** do we apply the chemicals on the plant, and what are the objectives and quantifiable criterions we can propose to optimize spray carts and compare the performances of the commercialized systems ?
- **How much** ? In the end, combination of these two topics should allow to estimate the minimum amount of chemical per cm<sup>2</sup> of vegetal able to assure the full efficiency of the chemical applied.

Efficacy of a spray being usually reached, evenly of distribution on the target and lowering of the dispersion in the environment become two fundamentals purposes. Optimized spraying so stands on improvement of the yield chemical intercepted by the vine on chemical sprayed. This new definition takes into account environmental purposes in the quality definition of a spray.

These three points (**where, how, and how much** ?) in addition with the answer to the question **when** constitute the four fundamental axes of the treatment decision. What is the present level of our practices ?

The purpose is not to reconsider registration laws which are settled for a maximum of chemical to be applied in the vineyards. The aim is to measure the improvement we are able to define, and to imagine a rational way of calculation of the chemical input : finally we'll try to adapt the posology of the treatment to the parcells specificities.

The first results are good and encourage us in this way. They show us that possibility of optimizing sprays is real : responsibility relies on the vinegrowers to developp their tools, methods, inventory of succes and fail situations, in order to undertsand and manage to produce long term quality wines within environmental respect.

Marc RAYNAL – Novembre 2002