

# Design of a decision support system for fungicide sprayings against *Sclerotinia* on oilseed rape

Marie Taverne<sup>1\*</sup>, Florent Dupeuble<sup>1</sup>

<sup>1</sup> CETIOM - BP4 - 78 850 Thiverval-Grignon, France, tel. 0130799500, fax. 0130799590  
[taverne@cetiom.fr](mailto:taverne@cetiom.fr) ; [dupeuble@cetiom.fr](mailto:dupeuble@cetiom.fr)

## ABSTRACT

CETIOM would like to propose a new method for *Sclerotinia* management. It should answer to farmers' and advisors' expectations and be appropriated to their means. For that, the potential users of this method are asked for questions about their habits and practices and about their opinion on existing tools (risk level grid and petal test). Results obtained incite CETIOM to simplify and precise the tools working, to anticipate others use conditions than these initially imagined, and to propose arrangements of tools instead of independent tools. These evolutions involve some adaptations of experimental designs and methods used to evaluate tools, and the choice of a development strategy.

**Key words** : decision support system, decision support tool, *Sclerotinia*, risk level grid, Petal test, models, co-conception

## INTRODUCTION

*Sclerotinia* is a fungus which attacks many crops species. Heavy attacks on the oilseed rape at large scale are not very frequent (once to twice in a decade), but very prejudicial for farmers who got the habit to spray on every season. These practices lead to a large number of useless sprayings, which favoured for some years the emergence of resistances to currently used fungicides (Penaud *et al.*, 2003). CETIOM wishes to offer to farmers and to their advisors the way of spraying only if needed. For this work, needs of the users-to-be were collected, and the coherence of existing tools with their organizational means had to be determined.

## MATERIALS AND METHODS

In 2000, some agricultural advisors who use decision support tools to manage sprayings against different diseases on cereals, apple tree and vine were interviewed. Interviews were about the tools used working, the space scale and period on which they use them, the mean of elaboration and diffusion of advises to farmers, and the human means mobilised. Some CETIOM experimenters and regional engineers were also brought together to talk about needs and constraints of an eventual new method of *Sclerotinia* management. In 2001, on average 40 advisors who had first tested two existing tools, a risk level grid and a diagnosis petal test, were questioned about difficulties of implementation and about how the tools could be used. On average 30 farmers were also questioned about their practices and their *a priori* opinion about *Sclerotinia* tools without having used them before.

Use of the petal test consists in collecting 80 flowers by field at early flowering to plate them on dishes. After incubation for four days at 20°C the percentage of infested flowers can be determined. The risk level grid is composed of 12 questions about the field's past, the crop and field conditions at early flowering, the climate, and the amount of fungus available at early flowering. A mark is given to each question in accordance with the field's characteristics, and then the final score lead out onto an advise.

## RESULTS AND DISCUSSION

**The potential users' point of view about feasibility in using tools lead to simplify and precise their implementation.** Indeed, the advisors consulted after having tested them noticed some difficulties. The petal test was especially judged too much time-consuming and very meticulous (Taverne *et al.*, 2003). Ambiguity of some questions of the grid and a lack of references to harmonize answers was called. Further to this remarks, a more simple using method of the kit was proposed (Taverne *et al.*, 2003). Some questions in the grid were redrawn up, and the integration of some risk factors was modified to give more marks to the users. This amelioration of the grid was necessary for a similar notation of a similar situation by different users. As for the simplification of the kit, it was necessary for an eventual use in a decision support system, but its use keeps constraining.

In 2000, CETIOM had only planned to resume the grid's evaluation and to begin it for the kit. But **the decision support systems studied for other crops all included at least one climatic model.** So we wondered if an evaluation of *Sclerotinia* climatic models couldn't be interesting. Two advantages were identified :

- in the studied systems, using a model is a mean for the adviser to liaise with framers. It helps making more dynamic the disease risk management.
- severe attacks of *Sclerotinia* are focused on one or two years by decade in which many fields are concerned. So, the disease development is closely linked to climate, which justifies giving weight to this factor in estimating the *Sclerotinia* risk.

Moreover, **some talks with potential users of *Sclerotinia* tools revealed needs of information that are not given by the kit nor the grid as they stands.** A first point concerns the spraying date. All the more in case of dry climate, farmers and advisors would like some information to delay their spraying if possible. If some of them are not ready for impasses on *Sclerotinia* spraying, in countries where several sprayings are made during the flowering they're ready to reduce the number of sprayings if they can get information about the best spraying date possible. Then, because of resistances to fungicides, farmers and advisors search information to choose fungicides. In situations with resistance to BMC, this information would be associated with others about attack risk, in order to use top of the market fungicides only when the attack risk is high. Finally, a constraint for limiting fungicide sprayings against *Sclerotinia* consists in purchasing fungicides at "dead-season". If a reliable system identified when a spraying is needed, farmers and advisors would like to have earlier indications to organize the fungicides purchasing.

**It justifies first the introduction of other tools in the decision support system and then the adaptation of methods used for tools' evaluation.** So, CETIOM decided to collaborate with *Sclerotinia* models designers to evaluate their contribution in the decisions. But if CETIOM wants to support the choice of the spraying date, these model evaluation will have to be also for this and not only for the decision to spray or not to spray. This will need adapted experimental designs, with several spraying dates. Today, the first part of the grid consists in questions about the field and its situation. These information about risk early available could be used to help fungicides purchasing. But the first part of this grid doesn't identify well the *Sclerotinia* risk level of fields. If fields characteristics are shown important in estimation of *Sclerotinia* risk, their use will need to ameliorate the current grid or to make a new model of field risk estimation from information about field, its past and its environment. Giving to farmers and advisors a tool for characterization of *Sclerotinia* strains sensitivity to fungicides seems difficult today : the method needs a laboratory.

**Opinion and practices of the potential users show us other possible use conditions for tools and the interest of combining them. It makes us prepare adaptations of evaluation designs and methods.** Indeed, experimenters and persons in charge of development at CETIOM, and agricultural advisors consulted were dubious about the kit used in France by farmers as in Canada. They would better see its use by advise structures that dispose of necessary means. In that case, the kit won't be used on many fields. It will more probably be used on fields networks with extrapolation to other fields ; or only on some fields needing a precise diagnostic, selected with information easier to collect. And even if used by farmers, the measurement made on one field would probably be extrapolated to the whole farming. Using the kit in these conditions has consequences on the availability scale required. Especially if the results must be extrapolated, rules for that will have to be defined. It makes necessary having specific experimental designs to answer this question. In the same way, if the

kit is used at field scale but on some situations selected only, it means learning to identify them. As for the grid, it would be more interesting to divide its use all along the season : first the information available since sowing (field characteristics), then the climate and finally the crop condition at early flowering (flowers contamination level, crop density...). Besides, according to advisors, the climatic part would rather be completed by them than by farmers. So, the user would acquire a most and most precise information about attack risk until the beginning of flowering. This new approach requires writing new decision rules and adapting the tool's validation method. In the same way, in the decision support system studied, the use of information produced by tools complementary in time and space scales is optimised. *Sclerotinia* tools seem also complementary : so it appears much more interesting to combine them than to propose them separately. This would also need to write decision rules and to adapt the experimental designs in order to valid them.

**From this work about use conditions of tools, some ideas about ways of organizations of actors rise. They lead to prepare an adaptation of the development strategy of decision support systems for users.** Indeed, if the grid and the kit should be used at large scale autonomously by farmers on their fields, CETIOM would rather be "supplier" of tools, if necessary through advisers. Now, the use of kit on field networks would necessarily mobilize several actors : at least the fields owner farmers, other farmers wishing using the results, and a coordinator. This can lead the CETIOM to implicate itself more on the kit development : first through advises for extrapolation of results and perhaps until surrounding the setting on and sustaining of field networks. In that case, the necessary logistic will have to be forecasted. In the same way, if farmers are supported to complete the climatic part of the grid or if they receive results of climatic models, there will be exchanges between actors to gather together information necessary to decision. In that case, CETIOM could be an "inciter" for the setting on of necessary organizations for collect and diffusion of information. But CETIOM could also choose to take part to these exchanges by collecting itself information to furnish them to farmers and advisers. To have been concerned about conditions under which the tools could be used lead CETIOM to define more precisely its role in their use and sustaining. Anymore, the grid could be not completed each year question by question by user, but used as a support to make its expertise about risk factors, to identify types of situations and to precise the weight to give them in decisions. Finally, some advisers evoked the possibility of using the kit and the grid to acquire references or as a pedagogical tool, but not necessarily to decide. These finalities could have an impact on functionalities that should be given to the tool.

Our objective in proposing a management method usable and used lead us to think in simplifications and precisions for existing tools, to integrate other information that would be useful for users, and to know the way they will valorise information. Through that, we must adapt the tools' evaluation designs and methods, and the strategy of development.

## **ACKNOWLEDGEMENTS**

We thank in particular Marianne Cerf and Catherine Pasquier (INRA) for their methodological support and their active participation to this work, Jean-Marc Meynard (INRA) for his precious advises ; and also farmers, agricultural advisers and persons working at CETIOM who were interviewed.

## **REFERENCES**

- Morrall R.A.A., Thomson J.R.**, 1991. Petal test manual for *Sclerotinia* in canola. *University of Saskatchewan*.
- Penaud A., Huguet B., Wilson V. and P. Leroux**, 2003. Fungicide resistance of *Sclerotinia sclerotiorum* in French oilseed rape crops. *Proc. 11<sup>th</sup> Int. Rapeseed Congress., Copenhagen*.
- Taverne M., Dupeuble F., Penaud A.**, 2003. Evaluation of a diagnostic test for *Sclerotinia* on oilseed rape at flowering. *Proc. 11<sup>th</sup> Int. Rapeseed Congress., Copenhagen*.