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Is it possible to predict the aerial concentrations of *Venturia inaequalis* ascospores in apple orchards?

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In France, the most commonly used disease management strategy to control apple scab relies on a chemical protection applied during the primary period of ascospore ejections for any "Mills contamination risk" level, including the "Angers risk". A total of 15 to 20 fungicide treatments per year may thus be necessary to control the disease, according to years and regions.

However, it is possible to reduce the chemical protection during this primary period by the planting of low-susceptibility or Vf resistant cultivars (Brun *et al.*, 2007). In this case, only the main period of ascospore ejections (from 5 to 95 % of the ascospore stock ejected) associated with some levels of Mill's risks have to be protected. To be able to apply such strategy, it is necessary to determine accurately the main period of ascospore ejections.

MATERIALS AND METHODS

The aerial concentration of ascospores was assessed with Burkard 7-day volumetric spore traps installed on the orchard ground. Monitoring was made for 4 years in organic orchards of the Valence region (Drôme, France) and in experimental orchards not sprayed against scab in Maine-et-Loire (France). The modelling of ascospore ejections was based on data from weather stations located near the orchards computed by the 2 softwares used in France by extension advertising networks:

*Pulsowin[®] (version 3.01) and Melchior[®], 2 similar softwares based on maturation curves of Lagarde (1988).

*RIMpro[®] (version 2.0.5).

RESULTS

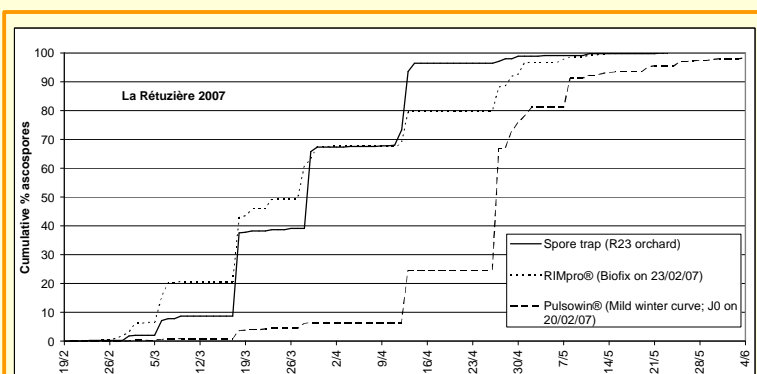


Figure 1: Ascospore ejections according to trap information and models in La Rétière (Maine-et-Loire) in 2007.

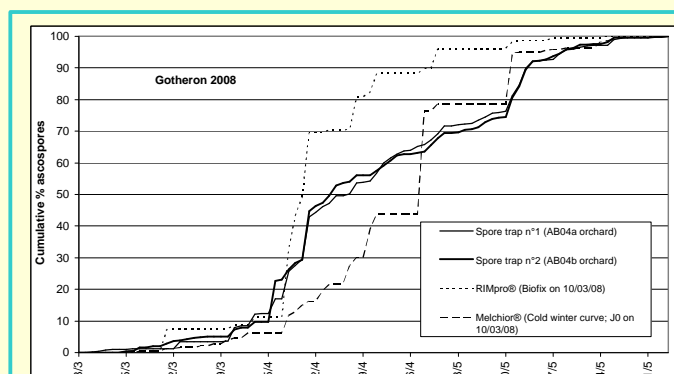


Figure 2: Ascospore ejections according to trap information and models in Gotheron (Drôme) in 2008.

Table 1. Differences in day numbers for the 5% and 95% ascospore ejection points between models and trap measures in Maine-et-Loire en 2004, 2005, 2006 and 2007

La Rétière	Total of ejected ascospores	5% of the stock	95% of the stock
2004	RIMpro [®]	6289	1 day B
	Pulsowin [®]	100%	3 days A
2005	RIMpro [®]	6476	4 days B
	Pulsowin [®]	100%	17 days B
2006	RIMpro [®]	4753	The same day
	Pulsowin [®]	100%	3 days B
2007	RIMpro [®]	6070	4 days B
	Pulsowin [®]	100%	22 days A

A : after spore trap; B before spore trap

Table 2. Differences in day numbers for the 5% and 95% ascospore ejection points between models and trap measures in Drôme in 2004, 2005, 2006 and 2008.

	Total of ejected ascospores	5% of the stock	95% of the stock
Loriol 2004	RIMpro [®]	5314	5 days A
	Melchior [®]	100%	The same day
Gotheron 2004	Pulsowin [®]	100%	2/3 days A
	RIMpro [®]	6097	9 days B
2005	Melchior [®]	100%	3 days B
	RIMpro [®]	6097	6 days A
2006	Melchior [®]	100%	2 days A
	RIMpro [®]	6097	8 days A
2008	Melchior [®]	100%	4 days A
	RIMpro [®]	5590	6/10 days B
	Melchior [®]	100%	2/6 days A

A : after spore trap(s); B before spore trap(s)

DISCUSSION

Applying specific strategies of treatment in the period between 5 to 95% of the ejections will only be possible if the discrepancy between the prediction of this period by the model(s) and biological facts is not too large. Our study showed that:

- Melchior[®] and RIMpro[®] predict 5% of the stock ejected too late 2 years/4 in the Drôme department and Pulsowin[®] 1 year/4 in Maine-et-Loire (Table 1 and 2; Figure 1). RIMpro[®] seems interesting to predict the beginning of intense ejections in Maine-et-Loire (Table 1).
- Pulsowin[®] and RIMpro[®] predict the end of important ejections (95% yet ejected) too early 1 and 2 years/4 respectively in Maine-et-Loire, and RIMpro[®] 1 year/4 in Drôme (Table 1 and 2; Figure 2). In this region, the best prediction of the end of important ejections was made by Melchior[®] (Table 2).

References:

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CONCLUSION

Models used in advertising networks for the prediction of ascospore ejections need a regional validation to support strategies permitting to reduce fungicide applications without inducing a risk for the fruit quality.