Horticultural Development Company

Grower summary

HNS 165

Prediction and sustainable management of rose powdery mildew

Final Report

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The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of the full report, please email the HDC office (hdc@hdc.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

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Headline

A prototype computer prediction model for rose powdery mildew has been developed. Field data showed that the model accurately predicted the overall trend of epidemic development. The model needs to be refined in consultation with rose growers, especially in user interface and in the formulation of practical strategies to use the predictions.

Food-grade potassium bicarbonate was as effective as Systhane 20EW or Nimrod against powdery mildew when applied repeatedly on mature plants but less so on young fast growing plants. Potassium bicarbonate was the only product that showed a significant effect in reducing conidia viability when applied to sporulating lesions.

Background and expected deliverables

Powdery mildews infect a wide range of ornamental plants and result in significant economic losses by disfiguring and blemishing leaves and flowers. The reduction in marketability, often caused by relatively low levels of infection, necessitates stringent control measures, which are currently achieved by intensive spray programmes. Intensive fungicide usage can result in unjustified applications and potential environmental pollution. They do not always control the disease satisfactorily due to poor timing or choice of fungicides and may accelerate the selection of mildew strains that are resistant to fungicides.

On susceptible plants, an appropriate strategy is to intervene with fungicides or alternative control agents, including naturally occurring products and biocontrol agents (BCA), when treatment is justified. This is called a 'supervised control strategy'. This requires knowledge of when there is a risk of disease. For rose powdery mildew, key information needed for a predictive disease risk model can be obtained from published information.

Operating a supervised control strategy also requires better understanding of the physical mode of action of available products: protectant (i.e. the ability to prevent mildew spores from infecting healthy leaves), curative (i.e. the ability to kill the young developing, but symptomless, colonies preventing them from forming visible lesions) anti-sporulant (i.e. the ability to reduce spore production), so the right products can be selected at the right time to control mildew. Recently, several alternative products have been shown to be effective against powdery mildew on other crop species.

There are two expected deliverables from this project:

1. a model forecasting mildew development on rose, delivered as prototype computer software that can be used directly by growers
2. identification of alternative chemicals that are effective against powdery mildew on rose and their main physical mode of action

Summary of the project and main conclusions

Model development

A prototype prediction model has been developed and implemented for rose powdery mildew as a stand-alone computer programme, which can use weather data (text) files of various formats generated by common data loggers. The model accurately predicted the overall trend of epidemic development under tunnels for two years. In consultation with rose growers, the model will be developed and will also enable supervised management of downy mildew. This development will take place under HNS 173, and should be available for use by the industry by summer 2012. Rose growers with a particular interest in the development of this model are encouraged to contact the HDC.

Testing alternative products

Several 'alternative' products were tested alongside 'standard' powdery mildew control products (Table 1).

Table 1 Summary of the products tested in 2008 and 2009 against rose powdery mildew

Trade name	Active ingredient	Application rate	Approval status	Protective	Curative	Anti-sporulant	Repeated	Notes
Serenade ASO®	*Bacillus subtilis* (strain QST 713)	10 ml L^{-1}	Approved	✓*	✓	✓	✓	
Farm-Fos-44®	Potassium phosphite	10 ml L^{-1}	Not approved	✓	✓	✓	✓	
Potassium bicarbonate	Potassium bicarbonate	10 g + 0.5 ml Silwet® L-77	Approved (commodity substance)	✓	✓	✓	✓	
Enzicur	Main ingredient is lactoperoxydase, an antimicrobial agent from milk	At a rate specified by the manufacturer	Not approved (currently under registration process in UK)	✓	✓			Only tested in 2008
Chitoplants®	Chitosan	0.5 g L^{-1}	Not approved (approved in Germany)	✓	✓	✓	✓	
Systhane™ 20EW	Myclobutanil	115 μl L^{-1}	Approved	✓	✓	✓	✓	
Nimrod™	Bupirimate	350 μl L^{-1}	Approved			✓	✓	Only tested in 2009
Milsana®	Extract of *Reynoutria sachalinensis and other ingredients*	12 ml L^{-1}	Not approved (but approved in several				✓	Only tested in

			other countries)					2009
Adjuvants								
Wetcit™	N/A	3 ml L^{-1}	Adjuvant	✓	✓			Only tested in 2008
Silwet® L-77	N/A	3 ml L^{-1}	Adjuvant	✓	✓	✓	✓	Only tested in 2009

*: ✓ indicates that the product was included in the specific test and does not necessarily indicate its physical mode of action.

The results from the product trial showed that the treatment effects against rose powdery mildew varied greatly between the single application and multi-application studies. When the products were tested for their effects against powdery mildew in a single application, either as a protectant or curative application, none of them showed consistent effects against the disease. In contrast, several treatments had significantly reduced powdery mildew development in the repeated application trials, these included the alternative products potassium bicarbonate and Farm-Fos-44® and, to a lesser degree, Milsana® and Silwet™ L-77. Serenade® ASO did not show any significant controlling effect against rose powdery mildew in this trial

When plant growth was fastest (leaf emergence and expansion), powdery mildew was best controlled by standard fungicides, such as Systhane™ 20EW and Nimrod™. Thus, the emphasis of powdery mildew control should focus on correct timing of fungicides in the early stages, gradually integrating other approved alternative products such as food-grade potassium bicarbonate possibly at reduced rates and/or increased intervals depending on disease pressure on the basis of model predictions.

Financial benefits

Growers can benefit from the project results in the following ways (exact financial benefits are difficult to quantify because it depends on many other factors such as variety susceptibility, growing environment, management practices, products used):

1) Using approved alternative products for effective integrated control of rose powdery mildew with the view to reducing reliance on fungicides but at the same time maintain plant quality
2) Controlling mildew stringently when plants are very young and gradually integrating fungicides (possibly at reduced rate or increased interval) with approved alternative products such as food-grade potassium bicarbonate.

3) Using the prediction model to partly determine the dose and application timing. We need to conduct further trials at growers' sites to investigate the control need (threshold) in relation to model predictions.

Action points for growers

- Request a copy of the model and the full report (which contains advice on Installing and running the prediction software within Appendix 2) from the HDC.
- Trial the model to assist in the control of rose powdery mildew (initially on a small scale).
- Once you have more confidence in the model prediction, gradually make decisions of mildew control based on the model predictions
- When available, use the combined model (being developed under HNS 173), for powdery and down mildew management.