



Evaluation of a disease forecasting model to manage late blight (Septoria) in celery

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Purpose of project:

This project details the outcomes of a 12-month study of late blight of celery which investigated efficacy and economics of the TomCast disease forecasting model for timing fungicide sprays to control late blight without reducing quality or yield.

Report completed: November 2005.

Acknowledgments:

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Media Summary

Model tackles sprays for celery late blight

Research has evaluated a computer model that can reduce the number of sprays for control of late blight in celery. Late blight is a fungal disease that attacks leaves and stalks of celery crops as they mature. Celery is usually sprayed weekly to control late blight, which can result in up to 16 sprays being applied per crop.

The model showed that savings on sprays could be made in the early stages of crop production, before the plant canopy closed in. Most savings were made on winter crops. The model predicted a saving of 7-8 sprays on winter crops and 3-5 sprays on summer crops but only in the early growth stages.

The model is called TomCast and it uses weather data to forecast the appearance of late blight in crops. Temperature and leaf wetness data are collected by a weather station positioned in the crop and fed into a computer-based model. The model determines when to spray and when not to spray for late blight. If conditions were favourable for late blight and provided no sprays had been used in the last 7 days, then a spray should be applied. If conditions were not favourable for late blight then the model shows that no sprays should be applied.

To date the model is only suitable for early stages of crop production before canopy closure. More research is required to make it suitable for later stages of growth. Options to enhance the model's performance are:

- (a) Application of a systemic fungicide with curative activity at canopy closure, followed by lower spray thresholds or weekly sprays of preventative fungicides.
- (b) Determining the lowest temperature for late blight symptoms to appear in the crop and then lowering the temperature threshold which triggers spray applications.
- (c) Evaluation of alternative disease predictive models.

If successful the model would be an economical means of reducing chemical sprays without compromising yield or quality.

Research by scientists at DPI's Knoxfield Centre was supported by funds from the Vegetable Industry, Horticulture Australia, the Department of Primary Industries Victoria and the Federal Government.

Technical Summary

Celery (*Apium graveolens*) is a crop that needs to be intensively managed due to exceedingly high aesthetic standards required and low damage thresholds. Late blight, caused by the fungus *Septoria apiicola* Speg., is a major foliage disease of celery. The high disease pressure from late blight in commercial celery crops is managed by weekly spraying with contact fungicide sprays, up to 16 times after transplanting. Growers are keen to reduce pesticide applications to minimise production costs, even if by only one spray. The public is also demanding fewer pesticides and less contamination of the environment.

During this 12 month study, two trials were conducted to evaluate the disease forecasting model TomCast as a decision support tool for timing fungicide sprays for late blight control in celery. The model converts temperature and leaf wetness data, collected by a weather station in the crop, into disease severity values (DSVs) which are accumulated to reach a threshold for spray applications. An economic analysis appraised the cost effectiveness of the model for reducing sprays without compromising yield or quality.

The major findings were:

- The TomCast model was very effective as a decision support tool only in the early stages of crop growth prior to canopy closure. The model was not suited to later stages of growth.
- Most savings on sprays were made on winter grown crops. Spray thresholds of 10-20 DSVs could reduce 7-8 fungicide applications in winter.
- In summer grown crops spray thresholds of 15-25 DSVs reduced 3-5 fungicide applications.
- Efficacy data was obtained for the systemic fungicide difenoconazole (Score).
- The use of the TomCast model would be economical in the early stage of crop growth, before canopy closure, but has not yet been shown to be economical in the late stage.

Recommendations for future work:

- (i) A hypothetical spray program is proposed which requires field validation.
 - 20 DSVs till canopy closure, then apply a systemic fungicide, followed by weekly prophylactic sprays.
 - Trial TomCast at 20 DSVs, apply a systemic fungicide at canopy closure, followed by reduced spray thresholds of 10 and 12 DSVs using commercial air-assisted spray rigs.
 - Determine the lower temperature threshold for *S. apiicola* to sporulate and infect celery and incorporate these parameters into the TomCast model, or alternatively broaden the lower temperature range in the model from 13-17°C to 10-17°C and trial with 10 and 12 DSVs beyond canopy closure.
- (ii) Validate the computer version of the model.

Chapter 6

Technology transfer and recommendations

6.1 Publication List VG04016

- Minchinton, L. (2005). Celery growers check progress of Septoria Late Blight project. *VegeLink*, Vic Issue 21, p6.
- Minchinton, L. (2005). Growers check out celery disease project. *Good Fruit & Vegetables* Vol 15 (No.11), p8.
- Minchinton, E. (2004/5). New project tackles Septoria late blight in Celery. *VEGELink* NSW Issue 10: p6.
- Minchinton, E. (2005). Celery blight threat. *Southern Farmer*, June 2005, p12.
- Minchinton, E. (2005). Celery growers' blight project. *Gippsland Times & Maffra Spectator*. On the land Department of Primary Industries.17/5/2005 p 18.
- Minchinton, E. (2005). Research into late blight fungus. *The Colac Herald*, Monday, May 9 p8.
- Minchinton, E.J., Galea, V., Thomson, F. and Nadesan, S. (2005). Evaluation of the disease predictive model Tomcast for timing fungicide sprays for late blight control in celery. The 5th Australasian Plant Pathology Society Conference Handbook. Abstract. "Innovations for sustainable plant health". 26th-29th September 2005 Deakin University Waterfront campus, Geelong, Victoria, Australia. p 178.
- Minchinton, E.J., Galea, V., Thomson, F. and Nadesan, S. (2005). Evaluation of the disease predictive model Tomcast for timing fungicide sprays for late blight control in celery. The 15th Australasian Plant Pathology Society Conference Handbook. Poster. "Innovations for sustainable plant health". 26th-29th September 2005 Deakin University Waterfront campus, Geelong, Victoria, Australia.
- Minchinton, E., Nadesan, S., Thomson, F. and Vujovic, S. (2005). Reducing sprays for late blight in celery. Poster Werribee Expo 5-6 May 2005.
- Minchinton, E.J. (2005). Septoria on Celery. *Vegetable-Matters-of-Fact*. VegCheque. No. 23, 2pp.
- Minchinton, E.J. Model tackles sprays for celery late blight. pending.
- Minchinton, E.J., Galea, V., Thomson, F. and Nadesan, S. (2006). Evaluation of the disease predictive model TomCast for timing fungicide sprays for late blight control in celery. Abstract submitted to AUSVEG Conference, Brisbane, May 2006.

Steering committee meetings

Cranbourne and Werribee, 6 & 7 January 2005. Notes on 'Predictive model to manage Septoria in celery project'.

Cranbourne and Werribee, 2005/6 – pending.

Field days & workshops - notes.

Campbells Road Clyde 2 March 2005. Notes on 'An invitation to attend a field day on late blight control in celery'.

Celery Growers Meeting Queensland, 10 February 2006 – pending

Report to celery growers nationally – pending with Notes '.

6.2 Feedback Celery Field day, Campbells Road Clyde 2 March 2005.

by Slobodan Vujovic

T

He thinks it was a good, successful field day. Trial was in good condition, everyone could see the differences between treatments. But then again T said it is hard for him to be objective because he is familiar with the trial. Time was good, midday is the best time to see the effects of diseases. Speakers were good and clear. His only concern was that some growers did not fully understand how DSV works.

G

Field day was good and successful. Plots were good especially weekly sprays. Time for the field day wasn't an issue. G likes to see unsprayed plot in the trial just to compare the impact of chemicals. He also liked to see other chemicals used in the model, to assess their effectiveness. G is concerned about the weather station and their reliability.

P

P was impressed with the trial. Speakers were very good. He would like to see the next trial with lower DSV 10 and 12, they look more realistically to work for our area. Time is always an issue with veg growers.

K

Very satisfied with field day, and grower's response (only disappointment was that growers from Mornington Peninsula couldn't come, it was too far). E.E & Muir staff that were present think field day was successful. K thinks that field days are the best tools that the department can use to showcase its achievements. "Picture speaks better than thousand words". Next step will be to work with Syngenta towards Score[®] registration. K would like to be involved (consulted) in the planning of next trial.

6.3 Recommendations

The major findings of this project were that the TomCast disease predictive model was very effective decision support tool for late blight control in celery. It has the potential to reduce fungicide sprays for the disease in the early stages of celery production prior to canopy closure. Most savings on sprays were made on winter grown crops. Setting spray thresholds at 10-20 DSVs reduced 7-8 fungicide applications in winter. In summer grown crops setting spray thresholds at 15-25 DSVs reduced 3-5 fungicide applications. At present the model is not suited to later stages of growth and further research should be largely directed in this area.

Possible areas of future research are:

- (i) Investigate whether the use of the TomCast model till canopy closure, application of a systemic fungicide, followed by either weekly contact fungicide applications or lower threshold sprays of 10 or 12 DSVs; is as effective as weekly spraying throughout.
- (ii) Use of a higher range of DSV thresholds in the early stages of crop growth and lower DSV thresholds at canopy closure.
- (iii) Application of fungicides with a commercial air-assist spray rig to enhance fungicide coverage.
- (iv) Evaluate lower temperature thresholds for *S. apiicola* sporulation and infection of celery, e.g. 5°C to 10°C and incorporated these parameters into TomCast model to the trigger the first 'Mean temperature' category of the model.
- (v) Evaluate Lacy's (1994) model of 12 hr leaf wetness.
- (vi) Evaluate the infection model of Mathieu and Kushalappa (1993), as it employed a lower temperature threshold to trigger spraying.
- (vii) Determine the efficacy, curative activity and residue status of alternative systemic fungicides to propiconazole and difenoconazole (Group C) such as carbendazim (Group A) or one of the strobilurins (GroupK) to prolong the effectiveness of the Group C fungicides and enhance the late blight control options especially when using the TomCast model.
- (viii) Validate the computer version of the model.
- (ix) Validate the model in commercial crops in different growing regions in Australia.

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