KEEP WHAT WORKS WORKING

Boysenberries NEW ZEALAND

Addressing resistance management for a minor crop – the boysenberry experience

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The resistance problem

Berryfruit industries are minor crops in New Zealand and consequently a very limited number of crop protection products are registered for use on the crop. As a result, growers place heavy reliance of a few key chemical active ingredients to control pests and diseases. For boysenberry growers *Botrytis cinerea* (grey mould) is a challenging disease issue affecting fruit and is known to be a pathogen that has a high risk of developing resistance.

What is *Botrytis* (grey mould) in boysenberries?

Botrytis fruit rot is caused by the fungal pathogen *Botrytis cinerea* and can cause blossom blight and fruit rot. Infected flowers can turn dark and shrivel and develop a covering of grey fungal growth.

Initial infection of fruit can result in a watery rot on boysenberry drupelets which then develops into the typical grey fuzzy mould, characterised by clusters of white spores on the fungal mass.

High humidity and wet weather during the flowering or harvest periods greatly increase the risk of infection. When not controlled, grey mould results in deterioration of fruit quality, fruit rots and associated yield loss.



Boysenberries with botrytis (grey mould). Credit: Geoff Langford

Poor disease control hinted at problems, resistance screening raised the alarm

The boysenberry industry has placed heavy reliance on a few select crop protection products to control *Botrytis*.

Two products, Switch® and Pristine® have formed the backbone of the industry's control programme.

Following a few seasons of poor disease control there was suspicion amongst growers that this chemistry was no longer effectively controlling *botrytis*.

In 2021, Boysenberries NZ conducted *Botrytis* resistance testing of Switch® and Pristine®. Both products contain mixtures of two active ingredients:

- Switch®: cyprodinil (Group 9 – anilinopyrimidine (AP) fungicide) + fludioxonil (Group 12 - phenylpyrrole (PP) fungicide)
- Pristine®: boscalid (Group 7 – SDHI fungicide) + pyraclostrobin (Group 11 – QoI fungicide).

Resistance testing carried out by the Bioeconomy Science Institute for Boysenberries NZ found that Pristine® was severely compromised in its ability to control *Botrytis*, with *Botrytis* isolates having developed nearly complete resistance to both active ingredients in Pristine®. For Switch®, substantial resistance was found to the cyprodinil active ingredient such that the efficacy of this product was reliant on the fludioxonil component (Beresford *et al*. 2022).

Resistance screening found nearly complete resistance to both active ingredients in Pristine®.

That *Botrytis* had developed resistance to Pristine®, and Switch® was also compromised, was a critical finding for boysenberry growers and several other berryfruit and fruit industries.

The industry immediately stopped using Pristine® in their programme. A consequence of this loss of chemistry was that the industry had to find an effective replacement chemistry. Without many other agrichemical options, the boysenberry industry has used Prolectus® widely for *Botrytis* control. The active ingredient in Prolectus® is fenpyrazamine a Group 17 keto reductase inhibitor (KRI).



Resistance screening is a critical element for effective resistance management

The Pristine® experience has demonstrated to the boysenberry sector that reliance on a limited number of crop protection products and modes of action can lead to resistance developing, especially for high-risk diseases such as *Botrytis*.

Resistance screening has enabled the boysenberry sector to have a greater awareness of the effectiveness of the modes of action that are being used, and importantly the ability to make earlier interventions if there is a problem.

While screening has provided these insights, the sector was still constrained in its choice of fungicides to control *Botrytis*. Boysenberry growers have been relying on Prolectus® in combination with Switch® for *Botrytis* control for the past four years. There was concern amongst the sector that this practice may increase the potential for resistance issues.

To understand the efficacy of Prolectus®, Boysenberries NZ with the support of the A Lighter Touch (ALT) programme carried out resistance screening of the active ingredient - fenpyrazamine. Fungal isolates collected from boysenberry orchards were screened for sensitivity to fenpyrazamine.

Unfortunately, this screening indicated some resistance to Prolectus®. The suspicion is that historic use in the same region of another Group 17 fungicide – Teldor® containing the active ingredient fenhexamid, has likely selected for resistant populations, rather than recent Prolectus® use by boysenberry growers. Essentially extensive use of the same mode of action Group 17 on a different crop in the same region has resulted in the development of resistance. This demonstrates the importance of rotating chemical modes of action no matter what crop the disease is being controlled on.

Prolectus® has been determined to be unsuitable for continued use by boysenberry growers. Growers have been advised to stop using both fenpyrazamine (Prolectus®) and fenhexamid (Teldor®) as both belong to the same mode of action Group 17. Fludioxonil, available through Switch®, was found to still be performing well but it was recommended that its use is restricted due to cyprodinil (the other active ingredient in Switch®) having lost efficacy.

How has the boysenberry sector responded to the loss of effective fungicide chemistry?

A critical issue for the boysenberry sector has been the loss of chemical active ingredients due to resistance. The other critical factor is that the sector is lacking suitable chemistry not only to replace the chemistry that has been lost but the lack of new modes of action fungicides that can be integrated into a control programme at timings that will not exceed fruit residue tolerances. The sector has responded by using several approaches to find alternative crop protection solutions for *Botrytis* control.



Residue testing

There are few close to harvest fungicides can be used on boysenberries due to importing countries restrictions on the type and amount of pesticide residue found on fruit. Residue levels at harvest of five new mode of action fungicide products have been measured and all residues were below the MRLs set by importing countries. This provides the boysenberry sector with possible new fungicide options for *Botrytis* control.

Biofungicide screening

Screening of biofungicides to control *Botrytis* has been carried out with support of the ALT programme. One of the biopesticide options evaluated showed promising activity against *Botrytis*. Further trials in the following season showed the biological products did not reduce *Botrytis* in boysenberries, with most treatments performing similarly to the untreated control under high disease pressure. While results were largely inconclusive, the findings suggested two products may hold more promise, warranting further research.

Regular monthly discussions each season with growers

During the season, boysenberry growers participate in regular monthly discussions to coordinate spray scheduling and product selection in response to disease pressure. These regular meeting enable growers to have better visibility of seasonal conditions and allow all growers to make informed decisions about disease control.

Cultural practices on orchard to reduce disease inoculum

Boysenberry growers carry out a number of cultural practices to reduce disease pressure on-orchard. This includes:

- Canopy management to maintain good airflow and reduce humidity.
- Desuckering to manage the new, green canes that emerge from the base of the plant. By removing unwanted canes the plant remains productive, healthy, and easy to harvest.
- Removing debris such as dead plant material from the orchard, as a source of inoculum.

Boysenberry growers rely on a season-long integrated management approach that combines chemical prevention, cultural hygiene, and careful timing of fungicides.

Key learnings

- Resistance screening is a critical element for effective resistance management.
- *Botrytis* in boysenberries has shown resistance to some common fungicides, making it crucial to rotate chemical groups and to evaluate new control options.
- Boysenberry growers are very aware of resistance issues and the need to rotate chemical modes of action, however the choice of new fungicide modes of action that fit a boysenberry control programme are limited.
- Because of the lack of fungicide options, growers must look to integrated practices to control disease.

Reports and resources

A Lighter Touch. Botrytis control in Boysenberries. https://a-lighter-touch.co.nz/our-projects/botrytis-3/, accessed April 2026.

Beresford RM, Wright PJ, and Vergara M. 2022. Sensitivity of Boysenberry botrytis to fungicides in Switch® and Pristine®. A Plant & Food Research report prepared for: Horteye Limited. Milestone No. 90777. Contract No. 39176 var (Horteye), 39288 (Syngenta), 39289 var (BASF). Job code: P/341122/01. PFR SPTS No. 22143.

Smith, J 2024. Establishing the harvest residues of fungicides in boysenberries. A report prepared for Boysenberries NZ and A Lighter Touch. No. BNZ-2023-01. 14p.



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