



VITRUVIAN TECHNOLOGIES

Precision Disease Prediction for New Zealand Vineyards

A grower's guide to sensor-informed spray management

\$11,400/ha

Average annual cost
of current spray approach

33%

Spray rounds
eliminable through better
timing

\$4,000/ha

Disease losses
recoverable through early
detection

168 hrs

Forward prediction window

What the current approach is costing you

Most spray programmes in New Zealand vineyards run on a calendar. Rounds go out at fixed intervals regardless of whether infection conditions actually exist. That approach made sense before the tools to do it differently were available. Those tools now exist, and the cost of staying on the calendar is quantifiable.

The average total cost of calendar-based disease management sits at around \$11,400 per hectare per year. Roughly \$6,400 of that is spray waste: fungicide and application costs for rounds applied before infection risk materialises, or applied uniformly across blocks with materially different microclimate conditions. The remaining \$5,000 reflects direct yield and quality losses in seasons where disease establishes before the programme responds.

Three specific failures drive this cost.

- Fungal infection is a block-level event. Botrytis, powdery mildew and downy mildew are governed by canopy humidity, leaf wetness duration and localised temperature. These conditions vary significantly between adjacent blocks in the same vineyard. A regional weather station cannot resolve them, and a programme calibrated to regional averages will systematically misread risk at block level.
- Calendar timing is disconnected from infection biology. Powdery mildew spore release follows rainfall, not fixed dates. Spore-trapping trials across five New Zealand regions confirm that growers are consistently applying fungicides before measurable infection pressure exists. At least three rounds per season go out in advance of any inoculum.
- Unnecessary applications accelerate resistance. Near-complete QoI fungicide resistance is now confirmed in powdery mildew populations across Marlborough and Hawke's Bay. An entire chemical class has been lost. The Sustainable Winegrowing New Zealand programme caps botrytis applications at six per season. Programmes that routinely approach that ceiling have no capacity to respond when a genuinely difficult season arrives.

The direct spray cost alone ranges from \$996 per hectare per year in a low-pressure Central Otago season to \$1,674 per hectare in a high-pressure Hawke's Bay or Marlborough season. These figures cover fungicide product, operator labour and tractor running costs. They do not include resistance degradation, compliance risk or yield losses.



How Vitruvian works

Vitruvian deploys a network of low-power sensors across your vineyard at around two to three per hectare. Sensors sit at topographic inflection points and canopy density transitions, the locations where microclimate differences between blocks are most consequential. Readings transmit hourly to a single property gateway via LoRaWAN radio, a protocol designed for rural environments with ranges of 10 to 15 kilometres and no per-sensor SIM costs.

What the system does with the data

Microclimate readings flow through a four-layer prediction model that converts continuous sensor data into a specific, timed spray recommendation for each block and each disease target.

- It identifies which blocks in your vineyard carry the highest infection risk at any given time, distinguishing between adjacent microclimates that a single weather station would treat as identical.
- It calculates how many hours remain before infection threshold is crossed at each location for botrytis, powdery mildew and downy mildew. This is what turns reactive spraying into planned spraying.
- It generates a continuous risk score for each pathogen at each location, accounting for cumulative exposure history rather than treating individual hourly readings in isolation.
- It combines current risk with seven-day weather projections to identify the optimal spray window within the coming 168 hours. If you use a contractor, that forward window is what makes scheduling practical.

The system covers all three primary fungal pathogens in one programme. You receive a plain-language recommendation with a timing window, not a dataset to interpret.

Validation

The model has been calibrated against NIWA climate records for Central Otago across three growing seasons, including the 2023/24 La Nina wet year and the 2024/25 frost-and-humid-autumn season. Against 2025/26 season data it recommended 33% fewer botryticide applications with no change in powdery mildew coverage, consistent with the 2004 New Zealand Plant Protection Society field trial benchmark from Marlborough.

An active pilot is running at a Gibbston Valley vineyard through the 2025/26 season. Gibbston was chosen as the test site because it is the most demanding environment in Central Otago: the wettest sub-region, highest elevation, greatest topographic complexity. Results will be published as a supplement to the full technical whitepaper.



The value case

The \$11,400 per hectare figure breaks into two components that recover differently. Spray waste is recoverable at 33% through better-timed applications, the rate demonstrated in peer-reviewed New Zealand field trials. Disease losses are 80% recoverable through earlier detection across all three pathogen targets. The remaining 20% reflects factors outside spray programme control: post-veraison berry splitting, varietal susceptibility and extreme weather events.

	8ha Central Otago	15ha Central Otago	15ha Hawke's Bay / Marl.
Spray waste recovery (33% of \$6,400/ha)	\$16,896	\$31,680	\$37,125
Disease loss avoidance (80% of \$5,000/ha)	\$32,000	\$60,000	\$60,000
Total recoverable value	\$48,896	\$91,680	\$97,125

All figures NZD. Spray waste recovery at 33% of \$6,400/ha. Disease loss avoidance at 80% of \$5,000/ha. HB/Marlborough spray waste recovery reflects higher programme intensity.

Clean seasons and difficult ones

In a low-pressure season the value comes from spray savings: unnecessary rounds eliminated, input costs reduced, SWNZ compliance headroom preserved. In a high-pressure season, disease loss avoidance dominates. A 15-hectare Central Otago vineyard that avoids a moderate fungal outbreak recovers around \$60,000 in yield and fruit quality. The system delivers less in easy years and most in the years that actually threaten the vintage.

Sustainability

Spray passes are the primary driver of diesel consumption in the vineyard, which accounts for 56% of the vineyard emissions footprint and 17% of the New Zealand wine industry's total. Reducing unnecessary rounds generates measurable emissions savings alongside the financial ones. New Zealand Winegrowers' Roadmap to Net Zero 2050 identifies reduced diesel use and chemical application as critical industry priorities. Export buyers in the UK, EU and US are applying increasing scrutiny to pesticide residue profiles. An auditable reduction in spray rounds is a market access credential.

Pilot programme

Vitruvian is in active pilot engagement in Central Otago's Gibbston Valley and is expanding to Auckland, Hawke's Bay, Canterbury and Marlborough. A pipeline of approximately 165 vineyards representing over 5,300 hectares of planted area has been identified across these regions. The 2026/27 pilot programme is open nationwide.

Growers and vineyard managers interested in the programme are welcome to get in touch through the website.

vitruvian.co.nz

This document is based on the Vitruvian Technologies Whitepaper (2026). Financial figures are estimates based on conservative assumptions and will vary by vineyard, season and management practice. They are not a guarantee of specific financial outcomes. Vitruvian Technologies Limited is a New Zealand registered company.