Catching Spores Before They Strike: A BioScout Evaluation

An assessment of BioScout fungal spore detection through comparison with field observations and laboratory-confirmed diseases across vegetable crops

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Executive summary

This field evaluation assessed the ability of BioScout, an automated spore detection system, to provide early warning of fungal disease outbreaks in Pukekohe vegetable production systems. The study focused on Stemphylium Leaf Blight (SLB) in onions and Early Blight in potatoes, comparing BioScout spore detection outputs with weekly field observations and laboratory-confirmed disease. The project aimed to evaluate BioScout's accuracy and practical value for growers.

Key Findings

- BioScout detected airborne spores of SLB and Early Blight several days before visible symptoms appeared in the field under Pukekohe conditions, providing a lead time of approximately 5–12 days.
- Laboratory confirmation qualitatively validated BioScout's Artificial intelligence (AI)-based identification of spore types, reinforcing confidence in detection accuracy.
- Environmental factors, particularly rainfall, leaf wetness, and temperature, were temporally associated with changes in spore concentrations and field incidence.
- Weekly field assessments in single-season, single-site conditions, alongside interpretation of results, limited resolution of short-term disease dynamics and broader application of conclusions.

Bottom Line

BioScout demonstrated strong potential as an early-warning tool under the conditions tested, providing actionable lead time when interpreted alongside weather data and disease biology. While highly useful for forecasting outbreaks, BioScout should complement, rather than replace, field scouting, particularly for new or uncommon pathogens.

1. Background

1.1 Project scope

Fungal diseases in commercial crop production are becoming increasingly difficult to manage due to rising pathogen resistance, the emergence of uncommon diseases, and the declining efficacy of fungicides. In response, new technologies have emerged to assist growers in monitoring and disease outbreaks, enabling more informed decisions regarding chemical control strategies.

One of the latest innovations in this area is BioScout, an automated disease detection system designed to identify airborne fungal spores before visible symptoms develop in crops. This project aims to compare and validate BioScout's data outputs against disease observations confirmed through field surveys and laboratory analyses across two crop types.

1.1.1 Objectives

- Validate BioScout's accuracy by comparing its spore detection outputs with field observations, laboratory-confirmed diagnoses, and weather data.
- Provide recommendations to growers and industry stakeholders on the suitability and practical value of BioScout for different production systems.
- Compare BioScout's performance across various crop types and environmental conditions to identify factors influencing detection accuracy
- Identify limitations and constraints of BioScout for practical use

1.2 BioScout

The BioScout unit is fully autonomous and can run for years without human intervention. It works by continuously draws in10 L of air per minute using a wind vane that aligns the intake with the prevailing airflow (BioScout, 2026). Airborne particles, including fungal spores, are captured on a clear adhesive tape; after each sampling period, the tape is automatically positioned beneath a microscope that captures hundreds of high-resolution images.

These images are sent to BioScout headquarters where specific spores are identified and counted using trained AI detection models. Spore numbers, along with environmental

conditions including temperature, humidity, rainfall, wind speed and direction are recorded and posted on the BioScout dashboard daily.

1.3 Diseases of interest

1.3.1 SLB (Onions)

Onion (*Allium cepa L.*) is one of New Zealand's most important crops, grown for fresh, processing, and export markets across the country. Onions contribute significantly to domestic consumption, economic value, and export revenue, with high per-hectare yields and year-round production supporting both food security and agricultural livelihoods (OnionsNZ, 2026). Maintaining health in onions is therefore critical to protect against diseases such as SLB.

SLB became a disease of concern for onion growers in New Zealand during an unprecedented outbreak in the 2017–18 season, especially in the Auckland, Waikato, Hawke's Bay, and Canterbury regions (Wright et al., 2019). SLB in onions is primarily caused by the fungus *Stemphylium vesicarium,* which poses a large threat as only two registered fungicides can be used to combat it.

Symptoms start as small, water-soaked leaf lesions that expand and darken to olive-brown or black, often coalescing and causing chlorosis and defoliation, reducing photosynthetic area (Hassan et al., 2020). Severe infection can result in premature senescence of leaves, compromised bulb quality and the opportunity for secondary infection (Hassan et al., 2020).

Primary infection occurs when spores or asexual spores (*conidia*) land on susceptible leaves, germinate, and penetrate through stomata or wounds, with lesions typically appearing 7-10 days post-infection (Chandel et al., 2022). Secondary conidia enable rapid, wind- and water-dispersed polycyclic spread during the growing season, with disease pressure highest under moderate temperatures (18–25 °C), prolonged leaf wetness, high humidity, dense canopies, and overhead irrigation (Misawa & Yasuoka, 2011).

Figure 1: SLB spore underneath the microscope (left) and active SLB lesion on a leaf (right).

1.3.2 Early Blight (Potatoes)

Potatoes (*Solanum tuberosum L.*) rank among the most important vegetable crops globally due to their high consumption and production. They can be grown across many variable conditions and climates and have exceptionally high yields per hectare, making the crop an important contributor to food security (Tsedaley, 2014). In New Zealand, over 50 varieties of potato are grown throughout the country, with large export markets making a significant contribution to the economy (Potatoes NZ, 2026). In current potato production, one of the most damaging and widespread diseases is Early Blight (*Alternaria).*

Early Blight is caused by two species of fungi: *A.solani and A.alternata*, with *A.solani* being most prominent in New Zealand (Potatoes NZ, 2026). The management of Early Blight is complicated due to the loss of efficacy of many chemical controls, highlighting the importance of alternative management options (Potatoes NZ, 2026).

Early Blight symptoms typically appear on older, lower leaves as small, brown to dark brown spots that enlarge and develop concentric rings (Tsedaley, 2014). These lesions cause surrounding chlorosis and lead to premature leaf drop (Tsedaley, 2014). Through these symptoms, Early Blight reduces potato photosynthesis via foliar necrosis and defoliation, delaying tuber bulking, lowering yield, and causing tuber lesions. Severe infections can cause up to ~30 % yield loss and compromise marketable quality (AHDB, 2026).

The pathogen survives between seasons as mycelium and conidia in infected crop residues, soil, infested tubers and alternative hosts such as nightshade species (Tsedaley, 2014). Upon landing on susceptible leaves, spores can germinate and infect within hours, with lesion development apparent within 5-7 days post-infection under moderate conditions (Salotti et

al., 2024). Secondary sporulation from these lesions produces additional conidia that facilitate repeat infection cycles throughout the season (Tsedaley, 2014). Infection intensity typically increases after crop flowering and during the tuber bulking phase. Environmental conditions that favour *A. solani* infection include warm temperatures, prolonged leaf wetness, and high relative humidity (Tsedaley, 2014).

Figure 2: Active Early Blight lesion on potato leaf

2. Methodology

2.1 Monitoring locations and crops

All crop monitoring was conducted at the Pukekohe Research and Demonstration Farm (Cronin Road). Monitoring focused on disease that was most prominent within the farm (SLB and Early Blight).

The crops assessed for disease were onion (*Pukekohe Long Keeper*) in plot 22 and potato (*Marabel*) in plot 7. These crops and varieties were selected because they are representative of those commonly grown in the local area and are susceptible to diseases of high concern for current local growers.

Onions were untreated for SLB; potatoes followed standard grower fungicide applications. Differences in fungicide programmes were due to differing trials that each plot was involved in.

Figure 3: Map of Pukekohe Demonstration farm highlighting the BioScout Unit and the plots monitored for disease (22 &7)

2.2 Field monitoring

To obtain a representative sample, multiple locations within each plot were assessed. At each point, 10 (onion) or 5 (potato) plants within a 0.5 m radius were examined for disease incidence and severity, repeated five times in a "V"-shaped pattern. In onions, 50 plants were assessed per sampling date, while in potatoes, 25 plants were assessed. Onions were monitored for a longer period due to earlier planting.

Each plant was scored 0–3 (0 = no symptoms; 3 = multiple lesions and signs of collapse). Scores were used to calculate overall plot severity and the proportion of symptomatic plants to determine incidence (%).

Diseased plant samples were collected and stored in the fridge for laboratory analysis.

2.3 Training the Unit

To identify spores in the field, the BioScout unit must first be ‘trained’ on what those spores look like. This is done through a spiking event, where the system is overwhelmed with one spore type, and can learn what it looks like for future identification (Appendix E).

2.4 Disease identification

Suspected foliar diseases identified during field scouting were confirmed using laboratory microscopy and selective culturing. Symptomatic leaf tissue was first examined under a stereo microscope to determine the presence of fungal structures. Where spores were observed, samples were processed for identification under a high magnification microscope (Appendix D).

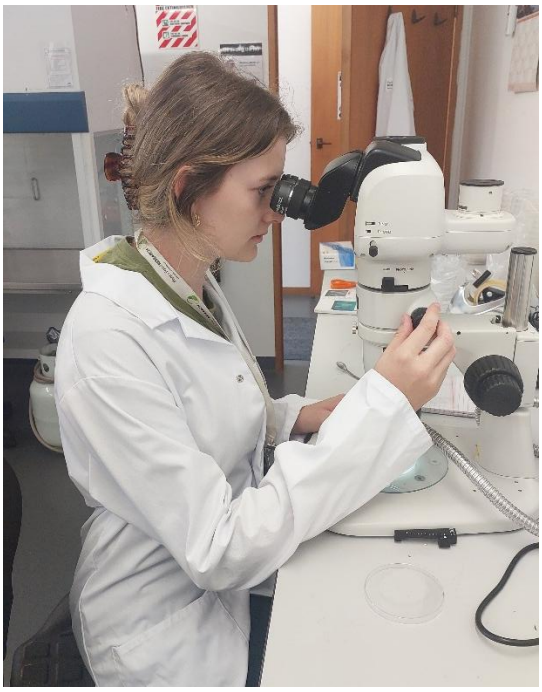

Figure 4: Use of Nikon zoom stereomicroscope for spore identification

In cases where sporulation was absent or insufficient for identification, leaf tissue was subjected to germination and then single-spore isolation on agar media. Resulting colonies were used to aid disease confirmation (Appendix D).

Figure 5: Examples of fungal colonies (Stemphylium) grown from a single spore on PDA (left) and water agar (right)

2.5 Comparison of data sets

BioScout concentrations (spores/ m^3 air) were compared with field observations. When a disease was confirmed in the laboratory, BioScout data from the previous 3-10 days was reviewed. If a clear increase in spores corresponding to the confirmed pathogen was observed during this period, BioScout was considered to have provided an early indication of the disease event.

2.6 Calculating severity percentage

Percentage severity was used to describe disease development because it combines multiple severity readings into a single value per monitoring date. The calculation weights each plant by its assigned severity score (v), multiplies this by the number of plants in that category (n), sums these products across all categories ($\Sigma(n \times v)$), and expresses the result as a percentage of the maximum possible disease level, calculated as the total number of plants assessed (N) multiplied by the maximum severity score (V):

$$\frac{\Sigma(n \times v)}{N \times V} \times 100$$

This approach allows small changes in symptom intensity to be tracked over time and enables direct comparison between assessment dates and treatments.

3. Results

3.1 Temporal trends of BioScout detection

BioScout detected intermittent low-level SLB spore presence through mid-November, followed by a clear increase from late November into December. This rise preceded the first measurable field incidence in onions on 1 December (4%) and low severity (1.3%) (**Figure 7**). Periods of elevated spore concentrations were consistently followed by stepwise increases in both field incidence and severity, generally 7–10 days after a spike (**Figure 9**). For example, the spore peak on 29 November preceded an increase in incidence from 4% to over 18% by 8th December, with severity rising over the same period. A series of peaks from the 19th of December preceded and incidence rise from 22% to 52% by the 30th of December. A major spike on 14 January (805.87 spores/m³) was followed within a week by maximum observed incidence (96%) and severity (69%).

For Early Blight in potatoes, BioScout recorded low spore levels until 25th December, when the first high risk spike occurred 5 days before the start of measurable field incidence (28%) and low severity (9.3%). Between the 1st and 8th of January incidence significantly increased from 28% to 80%. The last major spike for this period was on the 28th of December; however many low-risk spikes were present between the two dates. The most significant spore peak (440.32 spores/m³ on 14 January) was followed by an increase in incidence from 84% to 96% over 8 days. This also preceded an increase to 54.7% severity by 22–28 January (**Figures 8 & 10**).

Across the monitoring period, BioScout spore concentrations were typically low, with median values of 5.6 spores m^{-3} for SLB and 15.0 spores m^{-3} for Early Blight. Short-duration peaks reached maxima of 805.9 and 440.3 spores m^{-3}, respectively (**Table 1**). Moderate- and high-risk thresholds were exceeded more for SLB than Early Blight.

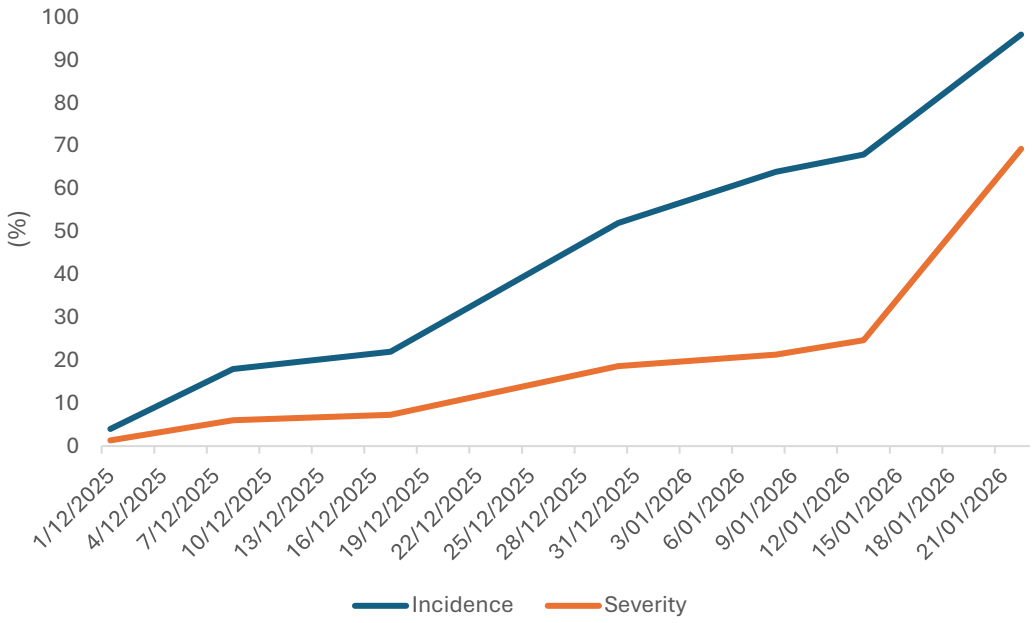

Figure 6: Incidence and severity of SLB in onions over selected monitoring period. Severity was calculated using $\sum(n \times v)/(N \times V) \times 100$.

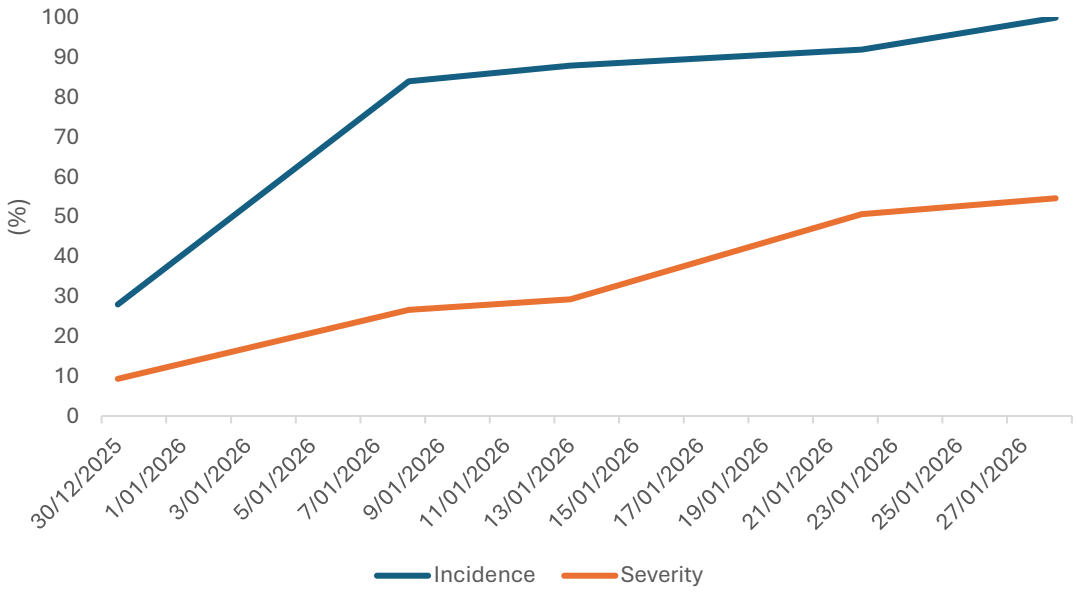

Figure 7: Incidence and severity of Early Blight in potatoes over selected monitoring period. Severity was calculated using $\sum(n \times v)/(N \times V) \times 100$.

Table 1: Descriptive summary of BioScout-generated airborne spore concentrations over the monitoring period

	SLB	Early Blight
Count (n)	75.0	43.0
Minimum (spores m^3/air)	0.0	0.0
Maximum (spores m^3/air)	805.9	440.3
Average (spores m^3/air)	27.7	28.2
Median (spores m^3/air)	5.6	15.0
Days above moderate risk (n)	16.0	7.0
Days above high risk (n)	10.0	3.0

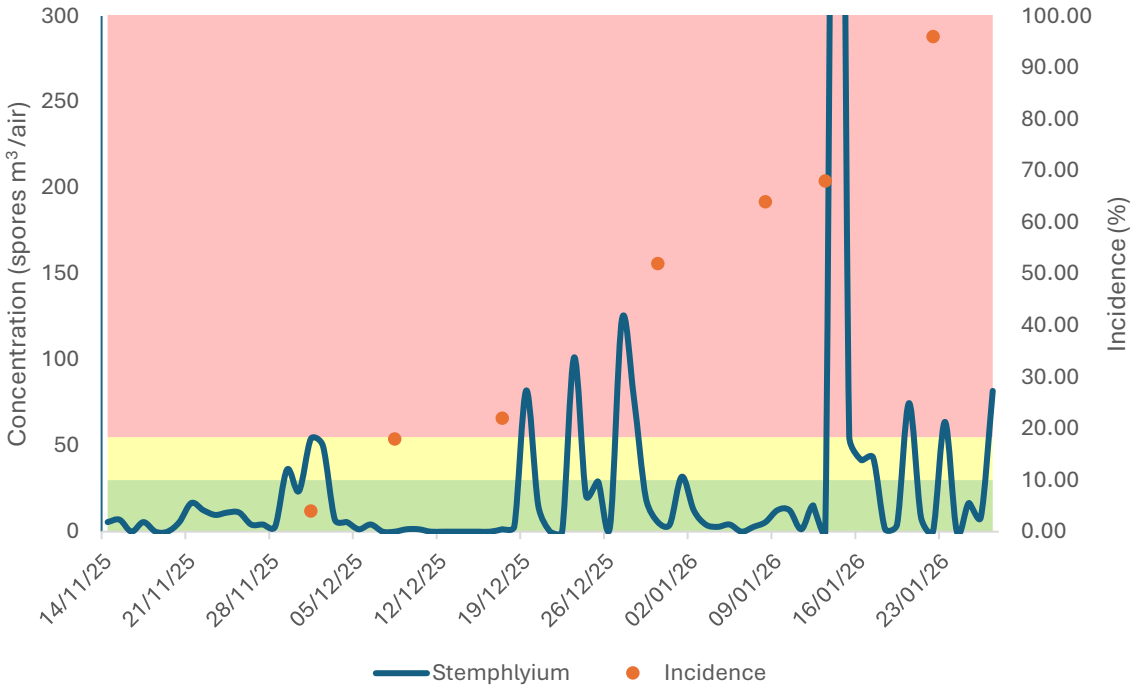

Figure 8: BioScout-measured SLB spore concentrations over time, with corresponding field-measured incidence. A traffic-light classification is used for spore concentration, where <25 indicates low risk, 25–50 indicates moderate risk, and >50 indicates high risk. The x-axis is truncated to emphasise temporal variation in spore concentrations; the maximum recorded value occurred on 14/01/2026 (805.87).

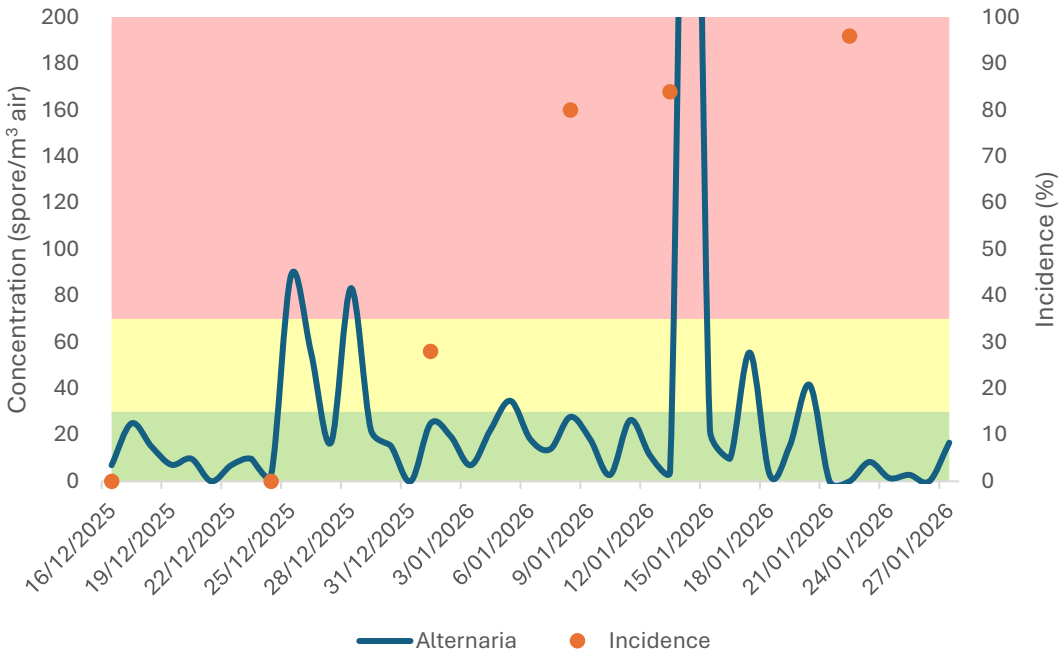

Figure 9: BioScout-measured Early Blight spore concentrations over time, with corresponding field-measured incidence. A traffic-light classification is used for spore concentration, where <30 indicates low risk, 30–70 indicates moderate risk, and >70 indicates high risk. The x-axis is truncated to emphasise temporal variation in spore concentrations; the maximum recorded value occurred on 14/01/2026 (440.32).

3.2 Laboratory observations

Laboratory analysis of leaf samples confirmed the presence of SLB in onions and Early Blight in potatoes, with clear spore presence and growth morphology. These results aligned with both the field-assessed symptoms and the BioScout spore detections, providing independent validation of the observed incidence and severity trends and reinforcing confidence in the accuracy of the monitoring approach.

3.3 Temporal weather patterns

Environmental conditions during the trial closely mirrored patterns of disease development in both crops. In November, intermittent rainfall, including a notable 51.7 mm on 18 November, and moderate temperatures (15.9–21.6 °C) coincided with early low-level SLB spore detection.

December featured rainfall on 2 December (9.1 mm) and 3 December (29.4 mm), which preceded measurable increases in field incidence and severity for both SLB and Early Blight.

Periods of warm, dry weather between 5–14 December appeared to limit rapid disease progression, temporarily slowing fungal establishment.

By January, warmer temperatures combined with major rainfall events, such as 15 January (28.6 mm) and 21 January (55.9 mm), aligned with the largest spore peaks and sharp rises in field incidence and severity, including maximum SLB incidence (96%) and severity (69%).

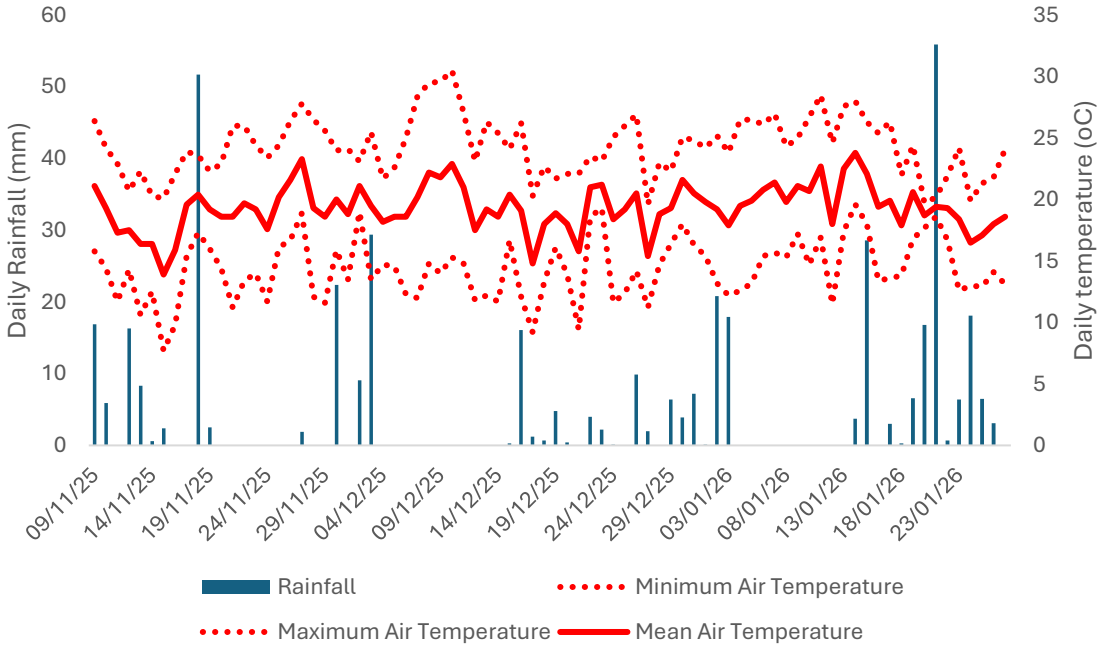

Figure 10: Daily weather data over the course of disease monitoring showing rainfall (mm), and Air temperature variations (ºC). Data sourced from the Pukekohe Research Farm weather station and published on Vegetables New Zealand Inc (VNZI) Weather & Disease Portal.

4. Discussion

4.1 Comparison between BioScout detection and field monitoring

4.1.1 Incubation periods

BioScout results indicated that spikes in SLB spore concentrations were followed by increased symptoms in the field occurring 7–12 days later. This pattern is consistent with reported incubation periods of 7–10 days, though exact incubation may vary depending on local climate and host susceptibility (Chandel et al., 2022).

Similarly, BioScout detected substantial Early Blight spore peaks 5–10 days before measurable field incidence, aligning with known incubation periods of 5–7 days (Salotti et al., 2024). For the large increase in incidence between 1st and 8th of December, it is hard to determine whether the high risk spike on the 28th of December was responsible or if the increase was a result of the cumulative small spikes occurring shortly after. Due to this there is a level of uncertainty around incubation periods for Early Blight under these conditions.

Overall, the system reliably identified early pathogen activity and provided advance warning of potential disease outbreaks under Pukekohe conditions.

4.1.2 Increasing incidence and severity

4.1.2.1 Environmental conditions

Over the monitoring period, weather fluctuated between dry, warm days and intermittent rainfall events, likely influencing disease development across crops. Dry periods, particularly in late November and early December, coincided with periods of low spore movement and limited infection, consistent with insufficient leaf wetness (Talley et al., 2002). In contrast, rainfall and high relative humidity preceding spikes in sporulation around 25–26 December and 14 January were associated with extended leaf wetness, which can support fungal germination, infection, and conidia production (Pokherl, 2021). The weather events corresponding with increases in disease incidence, severity, and BioScout-detected spore peaks show that environmental conditions likely influenced pathogen activity.

4.1.2.2 Canopy size

Canopy development directly influences disease incidence and severity by altering the microclimate around leaves and modifying the surface area available for infection (Vidal et

al., 2017). Larger, denser canopies tend to retain moisture longer after rainfall or dew events, creating conditions that favour infection (Vidal et al., 2017). As the crops progressed through their growth stages, increasing leaf area and canopy closure likely contributed to higher disease incidence and severity; though these factors were not measured directly.

4.1.2.3 Spore distribution patterns

Descriptive summaries of BioScout spore concentrations (**Table 1**) show that airborne inoculum pressure during the trial was characterised by generally low background levels punctuated by infrequent, high-magnitude peaks. The marked divergence between mean and median spore concentrations highlights the strongly skewed distribution of BioScout data, indicating that short-duration events dominated exposure patterns. While these peaks coincided with increases in severity/incidence, causality cannot be confirmed from the observational data.

4.1.2.4 Fungicide programme

Fungicide applications in potatoes likely impacted disease presence during the trial, however due to data constraints a clear relationship is difficult to see. Spore peaks frequently preceded increases in field incidence, but timing of sprays (Appendix B) coincided with or shortly followed these peaks. In some cases, field severity remained moderate despite high spore concentrations, suggesting that fungicide applications may have limited pathogen establishment or slowed disease progression.

At the maximum peak, SLB incidence increased by 28 and severity by 45, whereas the peak for Early Blight, which occurred on the same day, showed smaller increases of 12 in incidence and 21 in severity. Environmental conditions are unlikely to explain this difference, as both pathogens experienced the same weather in the subsequent days. Instead, the disparity may reflect differences in peak magnitude, pathogen behaviour, or a reduced apparent rate of increase for Early Blight due to its higher initial incidence and progression toward saturation. However, the most likely explanation is the fungicide application for potatoes on 14 January, which likely limited further disease development.

4.3 Grower implications

The temporal patterns observed in this study suggest that BioScout has value as an early warning tool for disease risk, showing increased spore pressure before visible symptoms were observed in the field. This lead time has practical relevance for disease management, as it

aligns with decision-making windows for fungicide application and crop monitoring. BioScout outputs were most informative when interpreted in combination with weather conditions and knowledge of disease biology, rather than as a standalone indicator. The tool has potential to support more timely and targeted disease management decisions, particularly during periods of rapid disease development.

4.4 Limitations

4.4.1 Scope

This study was carried out at a single site, under one set of climatic conditions, and over one growing season. Because of this, the results should be interpreted with caution, as BioScout performance may change under different conditions. The trial also focused on just two diseases with similar lifecycles, and the accuracy of the BioScout in detecting other diseases was not studied.

4.4.2 Interpretation of Results

Because both pathogens undergo multiple infection cycles, spore release typically occurs in a series of peaks rather than a single event, making it difficult to link a specific spike to subsequent field symptoms and define a precise incubation period.

BioScout detects spores at the genus level and cannot distinguish species; for example, *A. solani* versus *A. alternata*. While this limitation is minor for general management, it may be relevant for species-specific purposes. Additionally, BioScout cannot detect soil borne diseases, meaning early infections from soil sources may be missed.

Direct comparisons between Early Blight and SLB spore concentrations are limited because the two diseases were monitored on different crops, at separate locations, and under distinct management regimes, including varying fungicide applications. These factors influence both the number of spores produced and the observed disease severity, making it difficult to directly compare the pathogens.

4.4.3 Method limitations

BioScout data and field disease assessments were collected on a weekly basis. While this sampling frequency was sufficient to capture broad temporal trends, it may have missed short-lived sporulation events or rapid changes in disease development occurring between

sampling dates. More frequent monitoring would be required to characterise these short-term dynamics in greater detail.

4.4.4 Laboratory Confirmation

Laboratory assessments in this study confirmed the presence of pathogens but were qualitative rather than quantitative. This limits the ability to directly compare laboratory results with airborne spore concentrations.

5. Conclusion

This evaluation demonstrates that BioScout can provide reliable early detection of airborne fungal spores for key vegetable pathogens under Pukekohe conditions. Measurable spore peaks preceded visible disease symptoms by approximately 5-12 days, aligning with known incubation periods for each disease. The system accurately identified SLB in onions and Early Blight in potatoes, with laboratory confirmation supporting the technology. Temporal patterns observed in this study likely reflected both primary inoculum events and secondary infection cycles, highlighting the polycyclic nature of these pathogens and the influence of environmental conditions, particularly rainfall, leaf wetness, and temperature, on disease progression.

While the study was limited to a single site, season, and two diseases, the results indicate that BioScout has practical value as an early-warning tool for disease management. Its outputs are most effective when interpreted in conjunction with weather data and knowledge of pathogen biology, enabling growers to make more timely and targeted fungicide applications or crop monitoring decisions. However, BioScout should be used as a complement to, rather than a replacement for, field scouting and laboratory confirmation, particularly for uncommon pathogens or under conditions not represented in this trial.

Overall, BioScout represents a promising tool to support proactive disease management in vegetable production systems, improving the ability to anticipate outbreaks, reduce crop losses, and optimise fungicide use.

6. References

AHDB. (n.d.). Org.uk. Retrieved January 27, 2026, from Alternaria | AHDB

Chandel, R., Kamil, D., Singh, S., Kumar, A., Patel, R., Verma, P., Zimik, M., & Khar, A. (2022). *Screening of short-day onions for resistance to Stemphylium leaf blight in the seed-to-bulb stage (stage I) and bulb-to-seed stage (stage II). Frontiers in Plant Science*, *13*, 1063685. https://doi.org/10.3389/fpls.2022.1063685

Hassan, M., Yousuf, V., Shah, T. A., Bhat, N. A., Bhat, Z. A., Majeed, M., & Latief, R. (2020). Stemphylium blight of onion: A review. *Agricultural Reviews*, *41*(01). DOI:10.18805/ag.R-1902

Misawa, T., & Yasuoka, S. (2011). The life cycle of Stemphylium vesicarium, the causal agent of Welsh onion leaf blight. *Journal of General Plant Pathology*, *78*(1), 18–29. https://doi.org/10.1007/s10327-011-0352-8

New Zealand Facts. (2026). Potatoesnz.Co.Nz. https://potatoesnz.co.nz/potatoes/facts/

Onions New Zealand structure. (n.d.). Onions New Zealand. Retrieved January 27, 2026, from https://www.onionsnz.com/about-onions-nz/facts-and-figures/

Pokhrel, B. (2021). *Effects of environmental factors on crop diseases development*. Journal of Agriculture and Forestry Research, 12, 553. https://doi.org/10.35248/2157-7471.21.12.553

Salotti, I., Giorni, P., & Battilani, P. (2024). *Biology, ecology, and epidemiology of Alternaria species affecting tomato: ground information for the development of a predictive model. Frontiers in Plant Science*, *15*, 1430965. https://doi.org/10.3389/fpls.2024.1430965

Talley, S. M., Coley, P. D., & Kursar, T. A. (2002). *The effects of weather on fungal abundance and richness among 25 communities in the Intermountain West*. BMC Ecology, 2, Article 7. https://doi.org/10.1186/1472-6785-2-7

Tsedaley, B. (2014). Review On Alternaria (Alternaria spp.) of Potato Disease and its Management Options. *Journal of Biology, Agriculture and Healthcare*, *4*(27).

Vidal, T., Boixel, A.-L., Durand, B., de Vallavieille-Pope, C., Huber, L., & Saint-Jean, S. (2017). *Reduction of fungal disease spread in cultivar mixtures: Impact of canopy architecture on rain-splash dispersal and on crop microclimate*. Agricultural and Forest Meteorology, 246, 154–161. https://doi.org/10.1016/j.agrformet.2017.06.014

Wright, P. J., Searle, B., Tyson, J. L., & Mellow, K. D. (2019). The current outbreak of Stemphylium leaf blight of onion in New Zealand – identification of cause and review of possible risk factors associated with the disease. *New Zealand Plant Protection*, *72*, 10–20. https://doi.org/10.30843/nzpp.2019.72.254

7. Appendices

Appendix A: Disease monitoring data

Table 2: SLB monitoring in onions showing incidence and severity

		Severity				
	Incidence					Severity (%)
Date:	(%)	0	1	2	3	
1/12/2025	4	48	2	0	0	1.33
8/12/2025	18	41	9	0	0	6.00
17/12/2025	22	39	11	0	0	7.33
30/12/2025	52	24	24	2	0	18.67
8/01/2026	64	18	32	0	0	21.33
13/01/2026	68	13	31	3	0	24.67
22/01/2026	96	2	0	40	8	69.33

Table 3: Early Blight monitoring in potatoes showing incidence and severity

		Severity				
	Incidence					Severity (%)
Date:	(%)	0	1	2	3	
30/12/2025	28	18	7	0	0	9.33
8/01/2026	84	5	20	0	0	26.67
13/01/2026	88	4	20	1	0	29.33
22/01/2026	92	2	12	7	4	50.67
28/01/2026	100	0	13	8	4	54.67

Appendix B: Fungicide spray details

Table 4: Fungicide details for spraying over potatoes (Block 7)

Date:	Fungicide:	Active ingredient:
17/12/2025	Gem	Fluazinam
	Ventura	Metalaxyl
22/12/2025	Gem	Fluazinam
	Ventura	Metalaxyl
30/12/2025	Promanz	Mancozeb
	Procym	Procymidone
	Scorp	Haloxyfop-P
06/01/2026	Promanz	Mancozeb
	Procym	Procymidone
14/01/2026	Promanz	Mancozeb
	Reason	Fenamidone
	Score	Difenoconazole

Appendix C: BioScout data

Table 5: SLB and Early Blight spore concentrations extracted from BioScout

Date	*SLB* concentration (spores/m^3)	Early Blight spore concentration (spores/m^3)
14/11/25	5.55	
15/11/25	6.94	
16/11/25	0	
17/11/25	5.55	
18/11/25	0	
19/11/25	0	
20/11/25	5.55	
21/11/25	16.66	
22/11/25	12.49	
23/11/25	9.72	
24/11/25	11.1	
25/11/25	11.11	
26/11/25	4.16	
27/11/25	4.16	
28/11/25	2.78	

29/11/25	36.09	
30/11/25	23.6	
1/12/25	54.14	
2/12/25	49.97	
3/12/25	6.94	
4/12/25	5.55	
5/12/25	1.39	
6/12/25	4.16	
7/12/25	0	
8/12/25	0	
9/12/25	1.39	
10/12/25	1.39	
11/12/25	0	
12/12/25	0	
13/12/25	0	
14/12/25	0	
15/12/25	0	
16/12/25	0	6.94
17/12/25	1.39	24.99
18/12/25	3	15
19/12/25	82.14	7.14
20/12/25	15.27	9.72
21/12/25	0	0
22/12/25	0	6.94
23/12/25	101.34	9.72
24/12/25	20.82	2.78
25/12/25	29.15	88.84
26/12/25	2.78	55.53
27/12/25	123.55	16.66
28/12/25	77.73	83.28
29/12/25	19.44	22.21
30/12/25	5.55	15.27
31/12/25	4.16	0
1/01/26	31.93	24.99
2/01/26	12.49	19.43
3/01/26	4.16	6.94
4/01/26	2.78	22.21
5/01/26	4.16	34.7
6/01/26	0	18.05
7/01/26	2.78	13.88

8/01/26	5.55	27.76
9/01/26	12.49	18.05
10/01/26	12.49	2.78
11/01/26	1.39	26.38
12/01/26	15.27	11.11
13/01/26	0	4.16
14/01/26	805.87	440.32
15/01/26	55.53	22.21
16/01/26	41.65	9.72
17/01/26	43.03	55.52
18/01/26	1.39	2.78
19/01/26	4.16	15.27
20/01/26	74.79	41.55
21/01/26	8.31	0
22/01/26	0	0
23/01/26	63.86	8.33
24/01/26	0	1.39
25/01/26	16.66	2.78
26/01/26	8.33	0
27/01/26	81.9	16.66

Appendix D: Detailed Laboratory methodology

Media Preparation

Potato dextrose agar (19.5 g) and water agar (5 g) were each added to separate 500 mL bottles and brought to 500 mL with distilled water. Media were sterilised in a pressure cooker at high pressure for 20 min, cooled to room temperature, and poured into agar plates under a laminar flow cabinet (0.35 m/s) (20 plates per bottle).

Microscope Identification

Leaf samples showing disease symptoms were examined with a Nikon SMZ800N stereomicroscope for fungal spores. Spores were prepared for compound microscopy (Nikon Eclipse Si) by applying 30 µL distilled water to tissue, agitating to dislodge spores, transferring to a slide, covering with a coverslip, and observing at 10× and 40× magnification. Diseases were recorded following identification.

Sporulation

Leaf samples with visible spores were chopped, placed in 50 mL Falcon tubes with ~20 mL distilled water, and shaken for 1 min. A 30 µL aliquot was plated onto PDA and spread with a sterile spreader; plates were incubated for 1 week. Germinated spores were examined under a stereomicroscope in a laminar flow cabinet. Individual spores were isolated with a sterile scalpel or acupuncture needles and transferred onto water agar for single-spore colonies. In some cases, spores were transferred directly from leaf tissue to water agar without prior plating.

Appendix E: Detailed Spiking methodology

To perform spiking, whole plants exhibiting strong disease are collected from the field the day before. They are stored overnight in a cool room (11 °C) to simulate a dewy night and promote further sporulation. The following day, the plants are allowed to dry for several hours before transport to the BioScout unit. Spiking should be conducted under minimal wind conditions, with the unit actively sampling. At the unit, plants are gently shaken approximately 10 cm from the air sampling nozzle to release spores into the airflow. The unit identifies the most dominant spore image and, when associated with the disease provided by BioScout personnel, it can subsequently monitor that disease automatically.