

**Sniffing for Accuracy:
Canine Precision for Detecting
Phytophthora agathidicida in Soil Samples**

By Hannah Coyle¹, Kayla Rench², Nigel Adams¹, Diane Fraser¹

1 Environmental and Animal Sciences, Unitec

2 Pest Detection Dog Team, Auckland Council

“Sniffing for Accuracy: Canine Precision for Detecting *Phytophthora agathidicida* in Soil Samples”

Rationale & Objective



Figure 1: Wikipedia, 2024.
(https://en.wikipedia.org/wiki/Kauri_dieback#/media/File:Kauri_tree_with_kauri_dieback_advancing_lesion.jpg). Copyright 2024 Wikipedia.

- ***Phytophthora agathidicida***: Soil-borne oomycete pathogen causing kauri dieback (Bradshaw et al., 2020)
- **Pest detection dogs** trained to locate and identify *Phytophthora* pathogen as quick and reliable surveillance tool (Bassett, 2016)
- The dogs can discriminate between target (*P. agathidicida*) and non-target (*P. cinnamomi* and *P. multivora*) scents (Carter et al., 2023)

“Sniffing for Accuracy: Canine Precision for Detecting *Phytophthora agathidicida* in Soil Samples”

Rationale & Objective



Figure 2: Fiona Goodall, 2021.
(<https://www.gettyimages.co.nz/detail/news-photo/kauri-dieback-detection-dog-pip-exits-the-cleaning-and-news-photo/1311559358>). Copyright 2024 Getty Images.

- **Rationale:** New biosecurity concept results in canine detection methods that have not been fully investigated
- **Objective:** Assess the detection accuracy of a trained dog in identifying decreasing amounts of *Phytophthora agathidicida* in soil samples

“Sniffing for Accuracy: Canine Precision for Detecting *Phytophthora agathidicida* in Soil Samples”

Methods



Figure 3: Auckland Council, July 2023.
(<https://ourauckland.aucklandcouncil.govt.nz/news/2023/07/kdb-study/>). Copyright 2024 by Auckland Council.

- **Cohort:** ‘Marty’ and handler Kayla Rench
- **Experiment 1:** 1/10 soil samples randomly placed out contained the *Phytophthora* pathogen
- **Five weights tested:** 30g, 5g, 1g, 0.5g and 0.25g



Figure 4: Taken by author (Hannah Coyle), 2024

“Sniffing for Accuracy: Canine Precision for Detecting *Phytophthora agathidicida* in Soil Samples”

Methods



“Sniffing for Accuracy: Canine Precision for Detecting *Phytophthora agathidicida* in Soil Samples”

Methods

- **Experiment 2:** 5/10 soil samples randomly placed out contained the *Phytophthora* pathogen at varying weights
- **Five weights tested:** 0.1250g, 0.0625g, 0.0313g, 0.0156g and 0.0078g

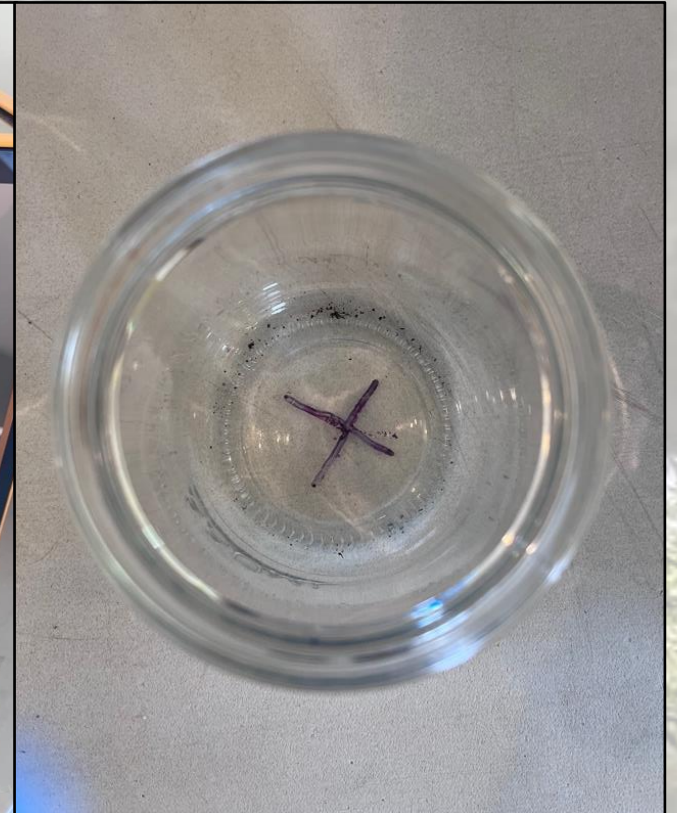
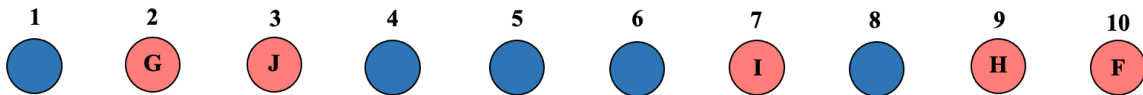


Figure 5 & 6: Taken by author (Hannah Coyle), 2024

“Sniffing for Accuracy: Canine Precision for Detecting *Phytophthora agathidicida* in Soil Samples”

Statistical Analysis & Results

$$\text{Sensitivity} = \frac{\text{True Positives}}{(\text{True Positives} + \text{False Negatives})}$$

$$\text{Specificity} = \frac{\text{True Negatives}}{(\text{True Negatives} + \text{False Positives})}$$

$$\text{Accuracy} = \frac{(\text{True Positives} + \text{True Negatives})}{(\text{True Positives} + \text{False Positives} + \text{False Negatives} + \text{True Negatives})}$$

Figure 7: Sensitivity, Specificity and Accuracy results for the first experiment [Graph]
(Created by author, 2024)

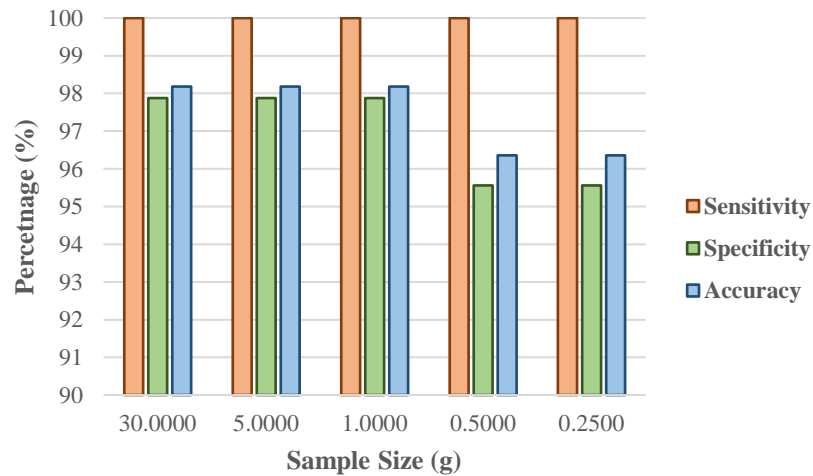
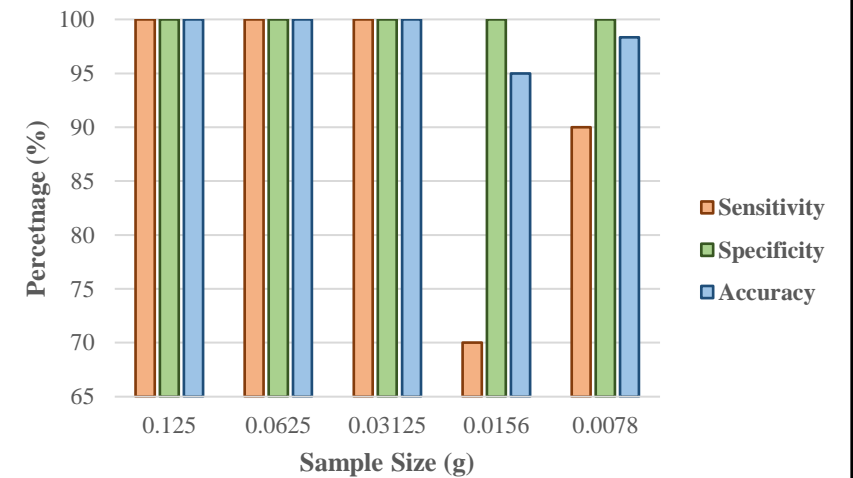


Figure 8: Sensitivity, Specificity and Accuracy results for the second experiment [Graph]
(Created by author, 2024)



“Sniffing for Accuracy: Canine Precision for Detecting *Phytophthora agathidicida* in Soil Samples”

Discussion & Conclusion

- Preliminary data to confirm detection of the smallest amounts of *Phytophthora agathidicida* in soil
- Great news for Auckland Council biosecurity efforts for minimizing spread of kauri dieback
- Future Recommendations: - In-field testing with larger cohort
 - Detectability at different *Phytophthora* pathogen life stages

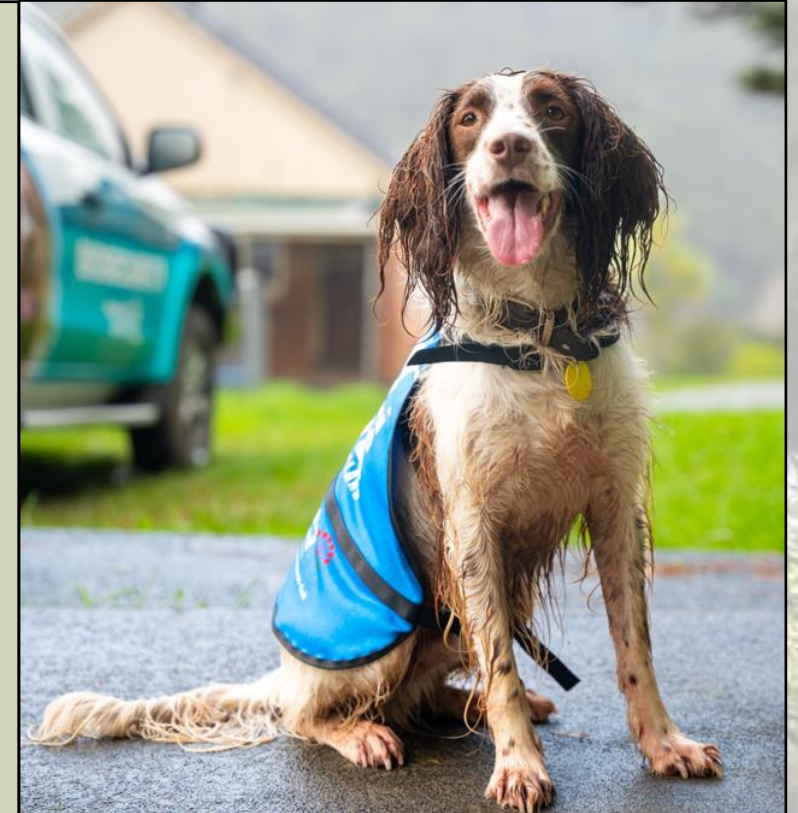


Figure 9: From *aklcouncil Instagram Page*, 2024. (https://www.instagram.com/aklcouncil/p/C9tYfVivvda/?img_index=4). Copyright 2024 by Auckland Council.

References

Bassett, I. (2019). Progress report: kauri dieback detector dog training. *Auckland Council Biosecurity*.

<https://www.kauriprotection.co.nz/assets/Research-reports/Surveillance-Detection-Diagnostics-and-Pathways/Progress-report-kauri-dieback-detector-dog-April-2016.pdf>

Bradshaw, R.E., Bellgard, S.E., Black, A., Burns, B.R., Gerth, M.L., McDougal, R.L., Scott, P.M., Waipara, N.W., Weir, B.S., Williams, N.M., Winkworth, R.C., Ashcroft, T., Bradley, E.L., Dijkwel, P.P., Guo, Y., Lacey, R.F., Mesarich, C.H., Panda, P. and Horner, I.J. (2020). *Phytophthora agathidicida*: Research progress, cultural perspectives and knowledge gaps in the control and management of kauri dieback in New Zealand. *Plant Pathol*, 69, 3-16. <https://doi.org/10.1111/ppa.13104>.

Carter, Z. T., McNaughton, E. J., Fea, M. P., Horner, I., Johnson, K., Killick, S., McLay, J., Shields, B., Stanley, M. C., & Glen, A. S. (2023). Evaluating scent detection dogs as a tool to detect pathogenic *Phytophthora* species. *Conservation Science and Practice*, 5(9), e12997.

<https://doi.org/10.1111/csp2.12997>

Acknowledgements

To Kayla Rench and Marty for donating their time and skills.

Auckland Council for the training facility and pathogen/control samples.

Background Image:

From *Nurseries no longer safe from Kauri Dieback*, Natural Science Challenges, by New Zealand's Biological Heritage, April 2019. (<https://bioheritage.nz/nurseries/>). Copyright 2024 by Biological Heritage.