New Project

Enhancing Resistance to Fungal Pathogens in Commercial Tree Species

CAFS 23.XX

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Justification

Image by Abigail Ferson

Image by: Jason A. Smith, 2010 (DOI:10.1111/j.1439-0329.2010.00659.x)

Justification

- Endophytes are nonpathogenic microsymbionts within plant tissues
- Competitive exclusion and antagonism occur among endophytes
- *Bacillus* is known to produce strong antimicrobial compounds and is commonly isolated from seed.

Image by Maria Marlin

Justification

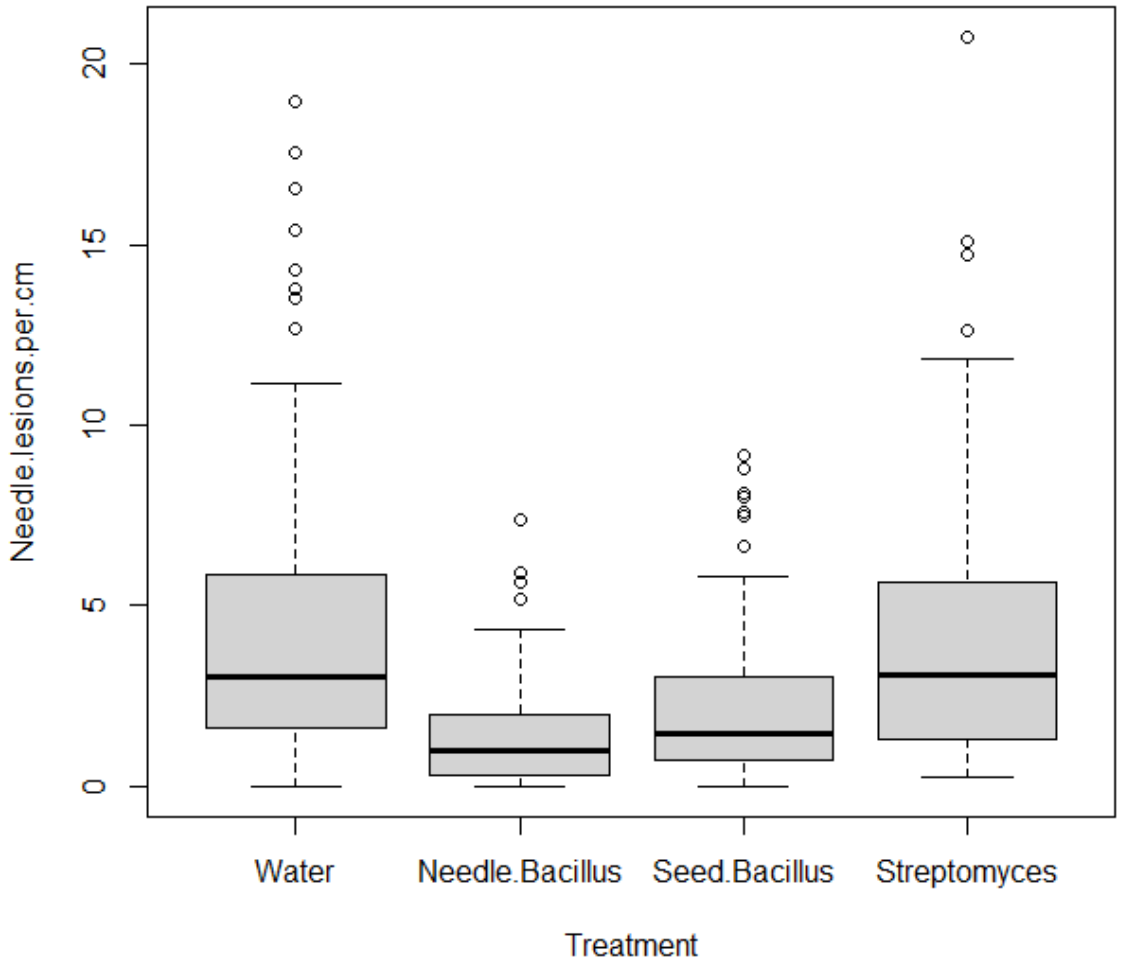

Figure 1. Total number of needle lesions divided by height (cm); one-year-old western white pine seedlings seven months post blister rust inoculation.

Justification

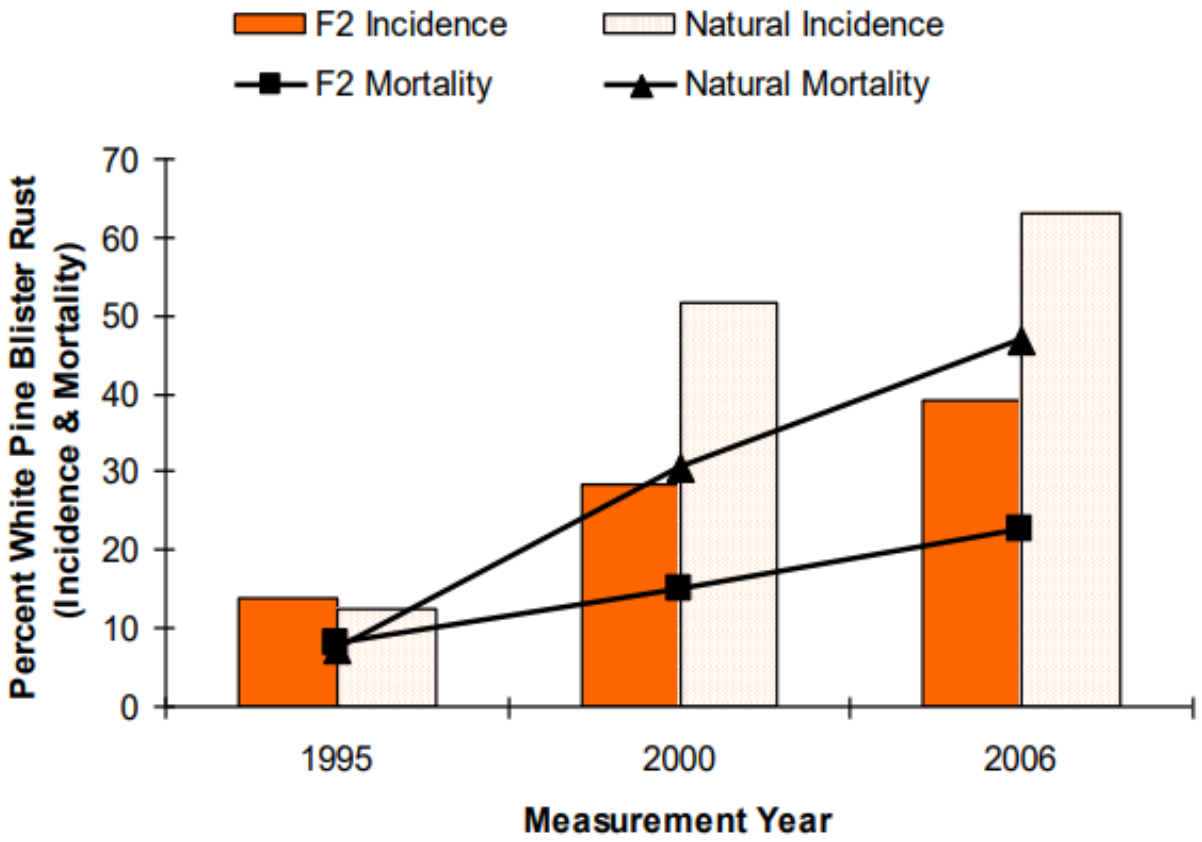

Figure 2. Cumulative white pine blister rust incidence and mortality due to white pine blister rust in 18 F2 western white pine plantations in northern Idaho (Figure 3 in Kearns, Ferguson, and Schwandt, 2012).

Hypotheses or Objectives

Objective:

- To enhance survival of commercial ‘resistant’ varieties of seedlings against virulent strains of devastating pathogens:
  1. *Acacia koa* against *Fusarium oxysporum f. sp. koae*.
  2. *Pinus monticola* against *Cronartium ribicola*.
  3. *Chamaecyparis lawsoniana* against *Phytophthora lateralis*.

Methods

Perform an endophyte treatment versus pathogen assay on seed from 'resistant' lots (Table 1) and include a repeat trial on 'susceptible' lots from 2022-2023 trials.

Species	Proposed Seed	Seed Source
Koa (*A. koa*)	Families w/ >70% survival from different ecoregions	Hawaiian Agricultural Research Center in Kailua, HI
Western white pine (*P. monticola*)	Bingham F2 bulklot	Originally sourced from Silvaseed Company
Port-Orford-cedar (*C. lawsoniana*)	Quantitative gene resistant lot (controlled cross)	USDA-FS in Dorena, OR

Table 1. Proposed resistant seed lots for 2023-2024 endophyte x pathogen assays.

Koa - Methods

Endophyte Inoculation

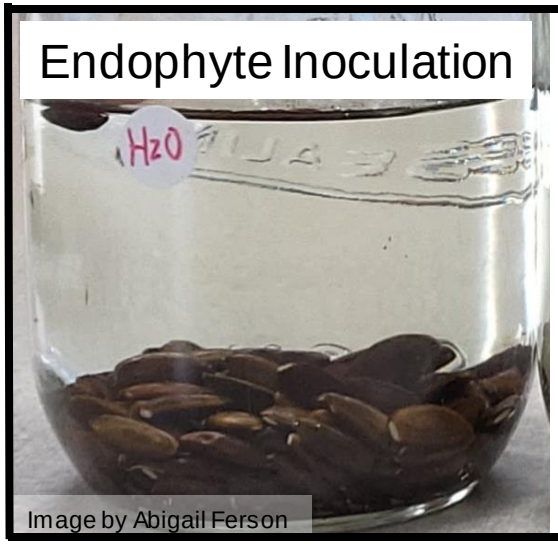

Image by Abigail Ferson

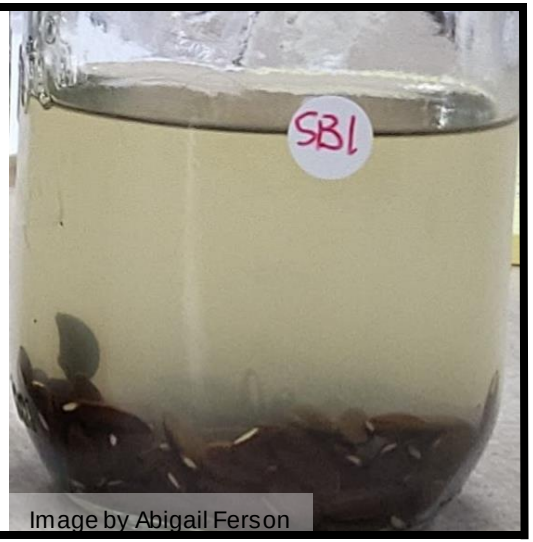

Image by Abigail Ferson

Pathogen Inoculation


Image by Abigail Ferson

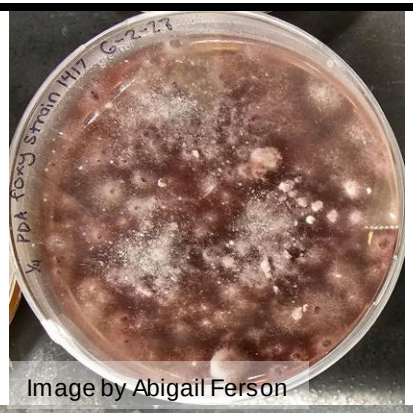
Image by Abigail Ferson


Image by Abigail Ferson

Data


Image by Michael Kaufmann

WWP - Methods

Endophyte Inoculation

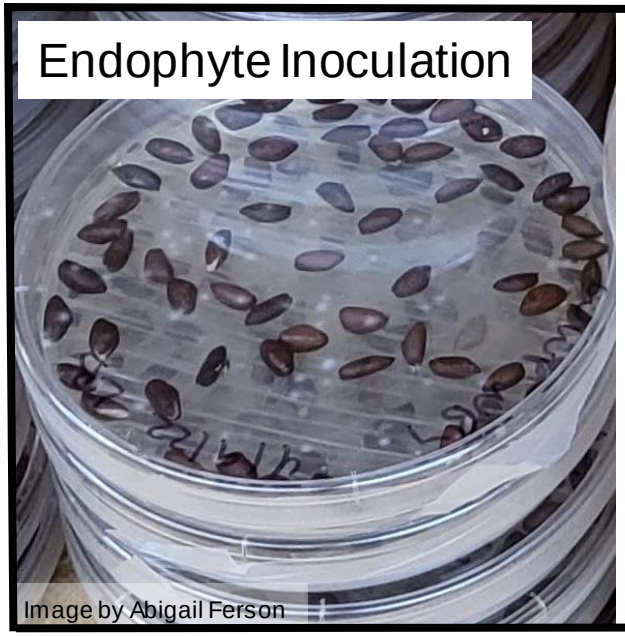

Image by Abigail Ferson

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Data

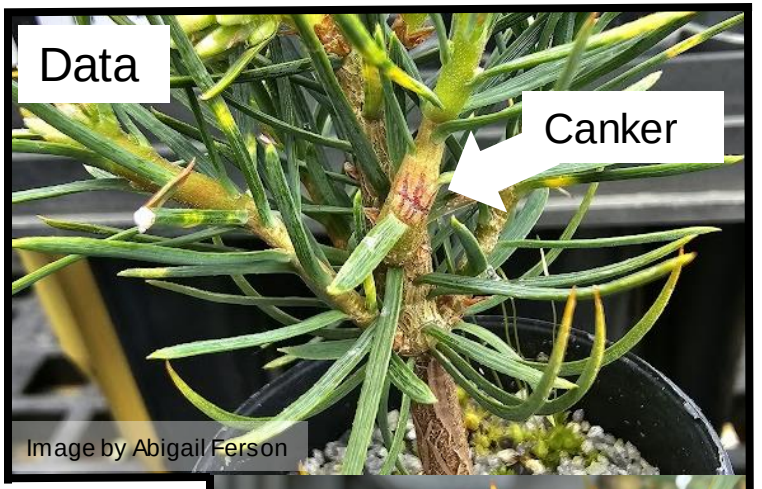


Image by Abigail Ferson

Pathogen Inoculation

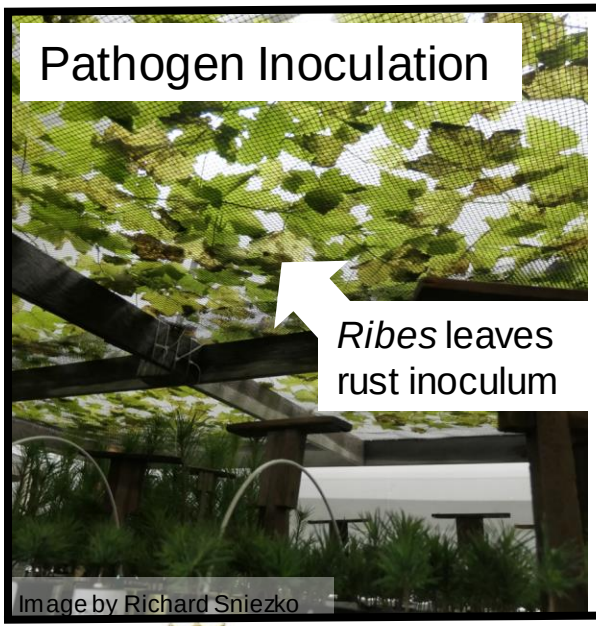


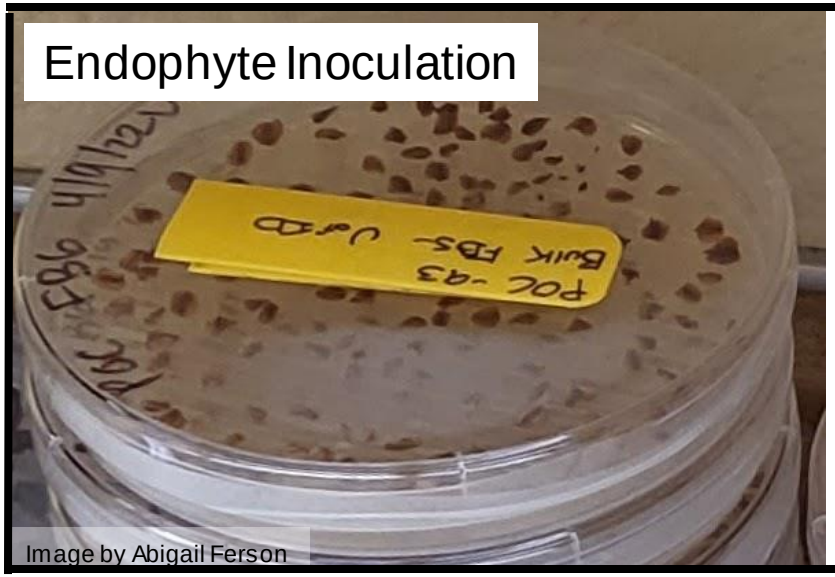
Image by Richard Sniezko

Image by Abigail Ferson

Image by Richard Sniezko

POC - Methods

Endophyte Inoculation



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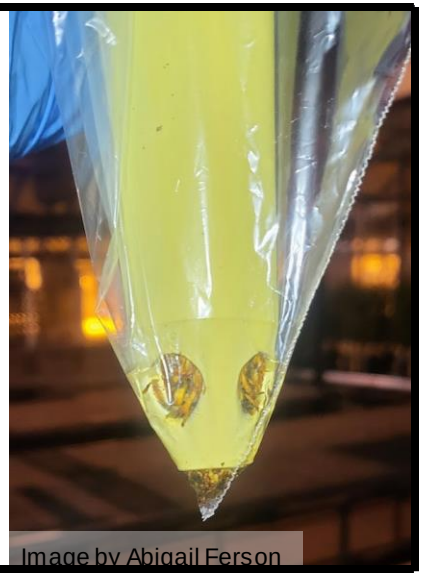

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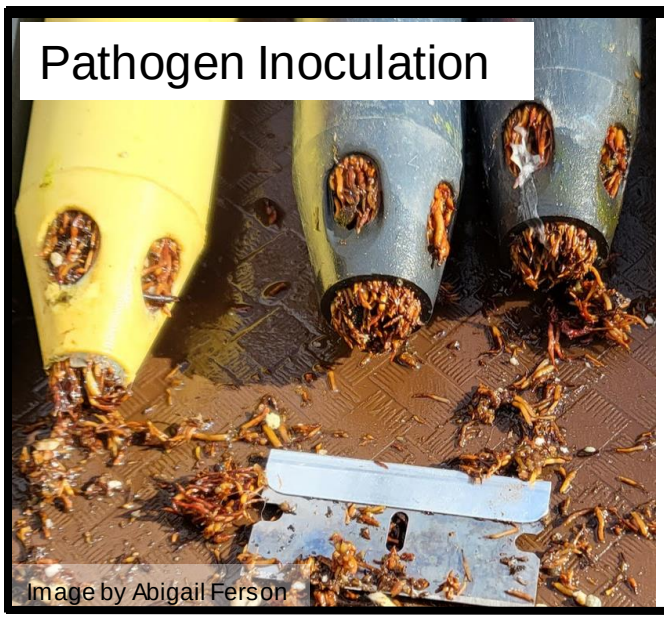
Pathogen Inoculation



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Data

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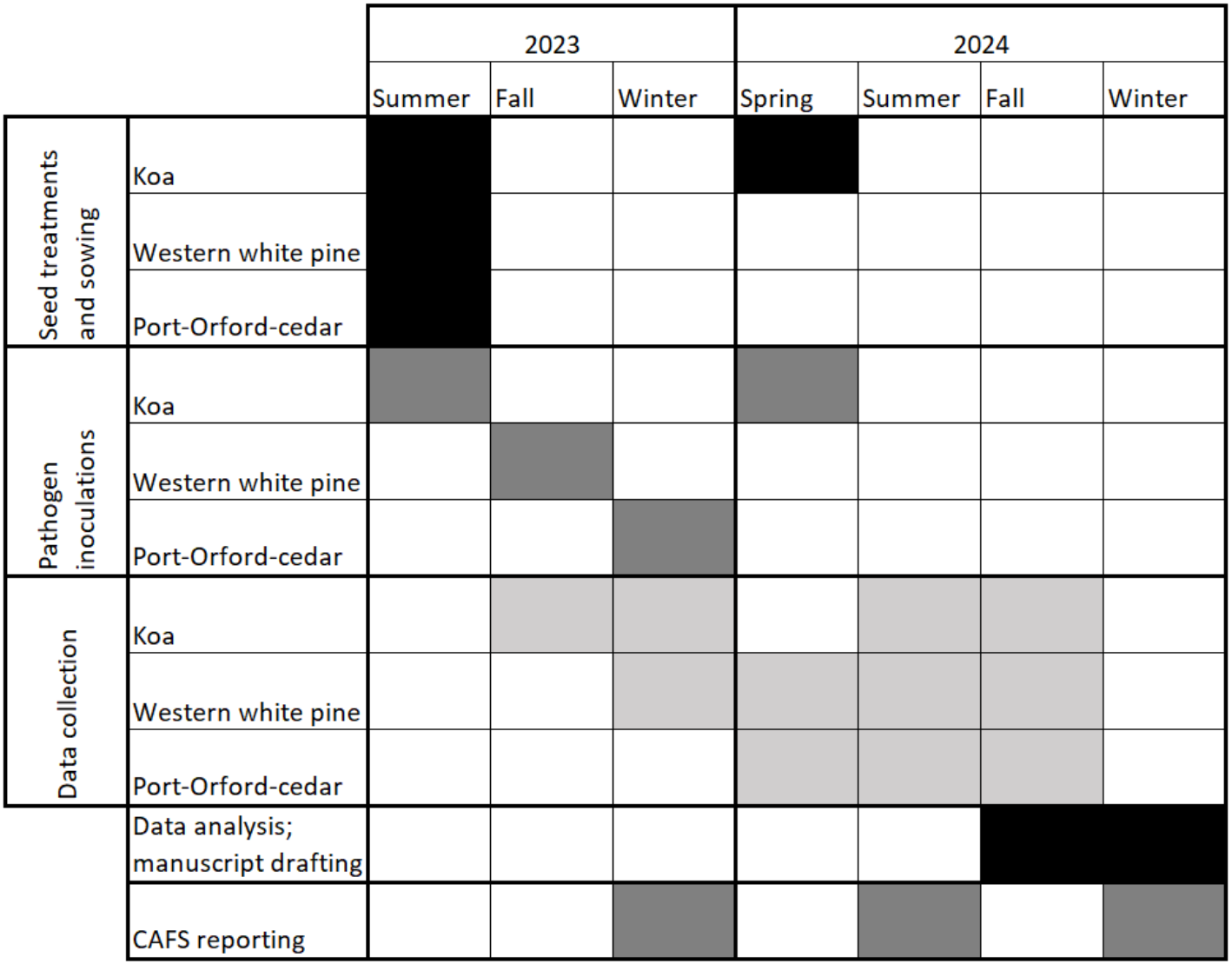
Project Timeline



Expected Deliverables

- Peer-reviewed publications, presentations to broad audiences, and a dissertation are anticipated to come from this research.

- Protocol for screening beneficial endophytes for effects against pathogens.

- Improved understanding on how endophytes can be used to enhance the survival and success of both susceptible and resistant families.

Company Benefits

- Reducing the cost and effort for reforestation following a failed plantation.
  - Enhance survival of out-planted resistant varieties in areas impacted by low-medium-high pathogen loads.
  - Increase survival of ‘susceptible’ families that lack genes for resistance but have other desirable genetic traits that improve hardiness and yield.

Summary

- Proposing to further expand upon research started by an NSF-CAFS funded internship, by including commercially important ‘resistant’ seed lots to enhance survival when out-planted.


Image by Abigail Ferson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