Project Summary

Ginger Ninja: Automated disease detection in seed ginger stock

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Pests and diseases pose a significant production concern to most ginger growers and are a constant threat to yields. Fusarium, in particular, is a key threat to seed ginger stock, as it can be spread through soil from infected plant material. Identification and removal of diseased seed stock is currently performed manually and is a major production cost.

The preparation of disease-free seed ginger takes place over three months and is a labour-intensive process (e.g. production of 400t requires about 20 people full-time for 12 weeks per year). Additionally, the nature of the process requires operators to stand for long periods of time while visually inspecting and preparing the seed stock.

Automation of Fusarium identification in ginger seed stock has the potential to significantly improve production rates and farm productivity. In recent years, camera technology and machine learning have demonstrated the ability to detect a range of pests and invasive species over many agricultural systems. This project will leverage these technologies and pilot the development of a real-time automated vision-based system that aims to rapidly identify Fusarium infected seed ginger stock for segregation from non-diseased stock.

Objectives

To develop and demonstrate an automated vision system that is capable of robustly identifying signs of Fusarium in seed ginger stock. The specific research challenges aim to:

1. Develop a vision system combing camera, lighting and algorithms for robust real-time identification of the presence or absence of Fusarium in cut seed ginger stock
2. Develop algorithms for the automated identification of the ginger root to facilitate cutting and inspection for disease.

Overview

This project will investigate a combination of camera options (RGB, infrared, multi and hyperspectral) and machine learning approaches in their ability to visually detect the presence of Fusarium in pre-cut ginger seed stock. The primary data collection will be conducted during the manual seed stock preparation (July-August). This will involve randomly selecting ginger seed stock from the production line. Each piece will be manually inspected for signs of disease, independently imaged using the camera options, and then a selection will be independently grown-out to confirm the presence/absence of Fusarium. The results of these independent assessments will be used to evaluate the performance of the developed algorithms. The research team will work with ginger growers and disease experts over a 12 month period in south east QLD to ensure project outcomes are relevant and applicable across industry.

Implications

Identification and removal of diseased seed stock is a labour intensive process, attracting high direct labour costs. As all ginger growers currently use a similar labour intensive seed stock production process, the outcomes of this research will be relevant industry wide. The development of a real-time automated vision system to identify signs of Fusarium in seed ginger stock will lead to reduced direct labour costs for ginger processors, and will also reduce the risk of repetitive strain injury associated costs. This will enable seed ginger to be produced as cost-effectively and safely as possible. Improving the productivity and profitability of ginger growers and Australia's ginger industry more broadly will increase Australian gingers' export competitiveness.

Desired outcomes

This research is aimed at achieving an automation level for robust and real-time "sorting" diseased from non-diseased ginger. The core outcomes are expected to be a vision-based algorithm for Fusarium in cut ginger seed stock as well as an algorithm to help automatically detect the bottom of ginger root stock. While out of scope in this project, the technology developed in this project is expected to provide the foundations for factory-based automated cutting of the ginger stock for inspection and removing disease from the ginger and slicing into seed pieces.

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