Studentship Project: Annual Progress Report 01/11/2022 to 31/10/2023

Student Name:	**Haidee Tang**	**AHDB Project Number:**	**SF/TF 170/a**
Project Title:	**Using climatic and imaging data to predict apple maturity.**		
Lead Partner:	NIAB		
Supervisor:	Xiangming Xu, Xiaojun Zhai, Jinya Su		
Start Date:	01/10/2021	**End Date:**	31/09/2025

1. Project aims and objectives

My project aims to predict apple fruit maturity in two ways. The first is by modelling the effects of climatic conditions on apple flowering time. The second entails using imaging information of individual fruits to predict fruit maturity.
The first approach comprises two parts: determining flowering time and assessing the impact of flowering time, fruit location within a tree canopy, and cultivar on fruit maturation. To achieve this, flowers within different canopy regions are tagged, and the labeled fruit will undergo maturity assessments.
The second objective uses imaging to determine maturity without destructive assessments. I have used a multispectral and a hyperspectral camera in the last year as well as spectroradiograph data previously collected.

2. Key messages emerging from the project

For the first objective, I have analysed the flowering and temperature data from the past 80 years from a range of apple cultivars in Kent. The PhenoFlex model with generic apple parameters can be used to predict flowering time. To study flowering time effect on fruit maturity, I have tagged apple flowers as they opened and then once mature, picked the fruit to record their maturity to determine the how the effect of time, region (within the tree canopy) and cultivar affects fruit maturity.

The second aim has made limited progress as I am still learning the computational skills necessary to analyse the data; nevertheless I have obtained imaging and maturity data for many indicvual fruits. I have trained a model to separate the apples in the images into individual apple images from images taken during my 2 month stay in New Zealand using a hyperspectral camera. This model has not been fully tested yet.

3. Summary of results from the reporting year

From analysis of the PhenoFlex model results, I have discovered that the best parameters for the model vary between cultivars. The PhenoFlex model also predicted flowering time better than an older model.
A model has been trained to separate individual apples from an RGB image.

4. Key issues to be addressed in the next year

The model for image sorting should be tested so that each apple imaged can be linked to a set of maturity values for starch, brix and firmness.
Overall, camera related terminology needs to be learnt to better understand imaging parameters.

5. Outputs relating to the project

(events, press articles, conference posters or presentations, scientific papers):

Output	**Detail**
CTP student talk	**17/02/2023 and 04/07/2023 – Conveying the key ideas of my projects to other students and supervisors in a 5 minute presentation**

6. Partners (if applicable)

Scientific partners	
Industry partners	Charnee Butcher and Lorraine Boddinton
Government sponsor	