

## Studentship Project: Annual Progress Report 1/11/2023 to 31/10/2024

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<b>Project Title:</b>	Using climatic and imaging data to predict apple maturity.		
<b>Lead Partner:</b>	NIAB		
<b>Supervisor:</b>	Xiangming Xu, Xiaojun Zhai		
<b>Start Date:</b>	01/10/2021	<b>End Date:</b>	31/09/2025

### 1. Project aims and objectives

- My first objective is to model the chilling and heat requirements of historical data collected at East Malling over the last eighty years. This is so we can estimate the time of flowering of apples.
- The second objective is to model the variables affecting fruit maturity between bloom and harvest to determine how much flowering time affects fruit maturity and if there are other variables affecting fruit development.
- Lastly, the third objective is to use imaging data to see if any wavelengths (or combinations of wavelengths) can be used to predict apple maturity.

### 2. Key messages emerging from the project

- Flowering time can be predicted using the PhenoFlex model within 5-6 days of accuracy by combining cultivars that flower at similar times to fit the model.
- Flowering time induces a significant amount of variation in fruit maturity at harvest. The amount of growing degree hours varies year to year so a model predicting the best harvest date from flowering date is insufficient to accurately predict optimum harvest dates.
- The rate of development for each cultivar is different, but very little effect was found for the factors: trees specimen or regions within canopy zones.

The results described in this summary report are interim and relate to one year. In all cases, the reports refer to projects that extend over a number of years.

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### 3. Summary of results from the reporting year

Increased variation in flowering time increases the amount of variation in fruit maturity at the time of harvest. Models predicting the optimal harvest time using data from the date of flowering is not enough as the main factor explaining the variation, Growing degree hours (calculated by the Growing Degree hours model) varies year to year. This means, fruit assessments are still required closer to the expected harvest date to accurately predict the optimal harvest window.

### 4. Key issues to be addressed in the next year

The focus for the next year is to train a model to determine apple maturity using imaging spectra data. Currently, I have code working for my hyperspectral data but this needs to be adapted for my new dataset. I also have multispectral data which will also need to be trained. The output will be to complete my third paper (Predicting fruit maturity using imaging).

### 5. Outputs relating to the project

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

Output	Detail
CTP student talk	23-Jan-2024 and 9-July-2024 - Conveying the key ideas of my projects to other students and supervisors in 15 minute presentations
Fruit focus stall	11-July-2024 – Chatting with industry and other visitors about my project
Paper in European Journal of Agronomy	Evaluating the performance of models predicting the flowering times of twenty-six apple cultivars in England – Publishing in August/September
ISEC poster and 1min pitch	15-19-July-2024 – 1 min pitch and poster presentation to 400+ participants at the International statistical ecology conference

### 6. Partners (if applicable)

Scientific partners	
Industry partners	Charnee Butcher and Lorraine Boddington
Government sponsor	