Project title:	Apple dormancy break in the context of climate change
Project number:	CTP_FCR_2017_2
Project leader:	Mark Else (NIAB EMR), Julien Lecourt (NIAB EMR) and Paul Hadley (University of Reading)
Report:	Annual report, December 2019
Previous report:	SF/TF 170 Annual Report 2018 CTP_FCR_2017_2
Key staff:	Carlota Gonzalez Noguer
Location of project:	University of Reading and NIAB EMR
Industry Representative:	NA
Date project commenced:	December, 2017

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[The results and conclusions in this report are based on an investigation conducted over a one-year period. The conditions under which the experiments were carried out and the results have been reported in detail and with accuracy. However, because of the biological nature of the work it must be borne in mind that different circumstances and conditions could produce different results. Therefore, care must be taken with interpretation of the results, especially if they are used as the basis for commercial product recommendations.]

AUTHENTICATION

We declare that this work was done under our supervision according to the procedures described herein and that the report represents a true and accurate record of the results obtained.

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GROWER SUMMARY

Headline

- Cultivar-specific models for predicting time of bud break have been developed for six apple cultivars in different climate change scenarios.

Background

Climate change is predicted to impact adversely on UK apple production, with warmer winters and an increased risk of late frost events of particular concern. Warmer temperatures will affect the dormancy cycle, which determines the timing and quality of bud break. Insufficient chilling can reduce and/or delay bud break (Petri and Leite, 2004), cause non-uniform flowering and, as a consequence, the production of smaller and abnormal fruits. At the same time, warmer spring temperatures can advance blooming dates, thereby increasing the risk of yield losses due to late frost events.

The dormancy cycle in apple trees is regulated solely by temperature (Heide and Prestrud, 2005), making the apple industry especially vulnerable to any changes in the climate. As chilling requirements vary between cultivars, in the short to medium term it is important to anticipate how different varieties are likely to respond to climate changes so that informed commercial planting decisions can be made over the next few decades. Whilst in the longer term it may be necessary to breed/select new varieties with reduced chill requirements.

Three main difficulties hinder the formulation of accurate predictions: (i) current chilling and heating models used for predicting bud break are not cultivar-specific, (iii) the models do not incorporate the climatic variability expected with global warming; and (iii) they often lack a link to biological principles as the physiological mechanisms behind dormancy break are not well understood. This project aims to investigate these three aspects with the final goal of developing an improved model for bud break prediction, which will be a useful tool to help to inform cultivar selection.

Using a combination of controlled environment experiments with excised shoots and potted trees, we investigated the relationship between temperature and time of bud break for six apple cultivars.

Summary

In the second year of this PhD we investigated the relationship between temperature and bud break of six apple cultivars. The effect of different chilling temperatures and durations of chilling were also studied. We developed cultivar-specific models incorporating winter chilling

and spring temperatures as factors determining time of bud break. These showed a cultivar-specific response to both factors as well as an interaction between chilling and spring temperature. Future work will continue investigating the effect of different chilling temperatures on bud break as well as some of the physiological mechanisms behind bud break.

Financial Benefits

This report summarises part of the work carried out in the second year of a four-year project, and so there are no direct financial benefits as yet. However, the project will provide key information for cultivar selection to the apple industry, a crucial decision for a crop with a lifespan of 15+ years and one that is highly susceptible to temperature changes predicted with global warming.

Action Points

There are no grower action points at this early stage of the project.