Project title:	Apple dormancy break in the context of climate change
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Project leader:	Mark Else (NIAB EMR) and Paul Hadley (University of Reading)
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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.

Carlota Gonzalez Noguer

PhD Student

University of Reading and NIAB EMR

Signature  18 January 2021

Report authorised by:

Dr Mark Else

Head of Department, Crop Science and Production Systems

NIAB EMR

Signature  Date 15 January 2021

Professor Paul Hadley

Director

Centre for Horticulture, School of Agriculture, Policy and Development, University of Reading

Signature  Date 15 January 2021

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GROWER SUMMARY

Headline

- The optimal temperature for chilling accumulation in apples trees is cultivar-specific and varies depending on the amount of chilling previously accumulated.
- Winter dynamics of soluble sugar profiles in different parts of the tree show potential as physiological markers to differentiate between dormancy stages.

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 episodes.

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, 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.

Three main difficulties hinder the formulation of accurate predictions: (i) current chilling and heating models used for predicting bud break are not cultivar-specific, (ii) 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 underpinning winter chill requirement and 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 longer-term cultivar selection.

Summary

In the third year of this PhD the effect of different chilling temperatures and duration of chilling on bud break of two apple cultivars was investigated. Freezing temperatures appeared to make a strong contribution to chilling accumulation, which had not previously been reported. Datasets are

being analysed and will be used to develop cultivar-specific chilling models in the final year of the project. A second experiment investigating winter dynamics of soluble sugar profiles showed peaks of sorbitol at different timepoints during the winter. Further work will continue to determine the potential of using soluble sugar profiles as physiological markers of dormancy break.

Financial Benefits

This report summarises part of the work carried out in the third year of a PhD and so there are no financial benefits yet. However, the project will provide key information for cultivar selection to the apple industry.

Action Points

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