Grower Summary

SF/TF 170
CTP_FCR_2017_2

Apple dormancy break in the context of climate change

Annual 2018

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

GROWER SUMMARY

Headline

- A preliminary model for studying time of bud break (TBB) has been developed using excised apple shoots.

Background and expected deliverables

Climate change is predicted to have an adverse impact 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.

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 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.

To define the relationship between forcing temperatures and bud break, heating requirements of a range of apple cultivars were investigated, using a combination of controlled environment experiments with excised shoots and monitoring of field-grown trees. Other variables that might have an influence on time of bud break were considered but temperature was the most important factor.

Summary of the project and main conclusions

In the first year of this PhD programme, we demonstrated that forcing temperature is the main determinant of time of bud break in apple shoots, although other factors such as cultivar and bud type (floral or vegetative) also have a significant influence. A preliminary general model including forcing temperature (temperatures above 16 ºC) was developed for all cultivars, and cultivar-specific models were generated for a range of cultivars. The initial results highlighted the importance of the cultivar-specific models, as varieties responded significantly differently to temperature. Future work will focus on combining the current model with chilling information for each cultivar, which is currently being investigated with excised shoots, potted trees and field grown trees. In summary:

- A preliminary model for studying time of bud break (TBB) has been developed using excised apple shoots. Results to date indicate that time of bud break is dictated primarily by forcing temperatures, followed by bud type (floral or vegetative) and cultivar

- Differences in TBB were observed between shoots on intact field-grown apple trees and excised shoots for a given cultivar. These could be due to insufficient chilling of excised shoots or an artefact resulting from using excised shoots
- Ongoing work is focusing on understanding the relationship between chilling temperatures and bud break to develop an improved model that can inform cultivar choice in different latitudes

Financial benefits

This report summarises the work carried out in the first 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 more than 30 years and one that is highly susceptible to temperature changes predicted with global warming.

Action points for growers

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