



Grower Summary

TF 215

A review of the most cost effective and efficient methods of thinning tree fruit crops in order to improve fruit quality and identify approaches worthy of further development

Final 2014

Disclaimer

AHDB, operating through its HDC division seeks to ensure that the information contained within this document is accurate at the time of printing. No warranty is given in respect thereof and, to the maximum extent permitted by law the Agriculture and Horticulture Development Board accepts no liability for loss, damage or injury howsoever caused (including that caused by negligence) or suffered directly or indirectly in relation to information and opinions contained in or omitted from this document.

No part of this publication may be reproduced in any material form (including by photocopy or storage in any medium by electronic means) or any copy or adaptation stored, published or distributed (by physical, electronic or other means) without the prior permission in writing of the Agriculture and Horticulture Development Board, other than by reproduction in an unmodified form for the sole purpose of use as an information resource when the Agriculture and Horticulture Development Board or HDC is clearly acknowledged as the source, or in accordance with the provisions of the Copyright, Designs and Patents Act 1988. All rights reserved.

AHDB (logo) is a registered trademark of the Agriculture and Horticulture Development Board. HDC is a registered trademark of the Agriculture and Horticulture Development Board, for use by its HDC division. All other trademarks, logos and brand names contained in this publication are the trademarks of their respective holders. No rights are granted without the prior written permission of the relevant owners.

The results and conclusions in this report may be based on an investigation conducted over one year. Therefore, care must be taken with the interpretation of the results.

Use of pesticides

Only officially approved pesticides may be used in the UK. Approvals are normally granted only in relation to individual products and for specified uses. It is an offence to use non-approved products or to use approved products in a manner that does not comply with the statutory conditions of use, except where the crop or situation is the subject of an off-label extension of use.

Before using all pesticides check the approval status and conditions of use.

Read the label before use: use pesticides safely.

Further information

If you would like a copy of this report, please email the HDC office (hdc@hdc.ahdb.org.uk), quoting your HDC number, alternatively contact the HDC at the address below.

HDC
Stoneleigh Park
Kenilworth
Warwickshire
CV8 2TL

Tel – 0247 669 2051

HDC is a division of the Agriculture and Horticulture Development Board.

Project Number: TF 215

Project Title: A review of the most cost effective and efficient methods of thinning tree fruit crops in order to improve fruit quality and identify approaches worthy of further development

Project Leader: Chris Nicholson, ADAS

Contractor: ADAS UK Ltd

Industry Representative: Nigel Kitney, Herefordshire

Report: Final report 2014

Publication Date: 24th December 2014

Previous report/(s): None

Start Date: 1st June 2014

End Date: 30th November 2014

Project Cost: £12,000

GROWER SUMMARY

Headline

This project has reviewed the latest scientific research, historical information and grower experience from around the world on fruit thinning and recommendations have been made for further study or investigation.

Background and expected deliverables

The overall aim of this project was to conduct a review of tree fruit thinning, primarily focusing on apple crops, but information from other tree fruit types was included where relevant, from both the UK and overseas. The review has identified potential areas of development of thinning practices in the UK which are economically viable and achieve optimum tree and fruit quality.

The specific project objectives were to:

1. Identify the gaps in our understanding of the physiology of fruit setting and fruit drop, and the control and management of these in relation to the different fruit thinning techniques to optimise fruit quality, size, cropping potential and also other aspects of fruit quality, particularly in relation to fruit storage;
2. Review and collate relevant UK and overseas information using, scientific literature, interviews with relevant stakeholders and researchers and other relevant UK and international sources regarding new technologies and or approaches to the science and practice of optimising fruit thinning;
3. Identify opportunities for future studies to examine appropriate and novel methods for flower and fruit thinning (including combinations of approaches) to optimise fruit quality and storability, either practiced or in development;
4. Provide a simple cost comparison of novel approaches or combinations of approaches if accurate information could be sourced.

Summary of the project findings

The biochemical processes involved in fruit set and fruit drop are complex and are controlled by a wide variety of parameters including; plant hormones, pollination, availability of water

and nutrients, orchard practices (such as pruning, cultivation, nutrition and plant protection product use), light, temperature, humidity and soil conditions. Understanding these, and how thinning approaches are acting upon them, is critical for optimum reduction in fruit number. The decision over which thinning strategy to use to provide the best results is complex and will vary from orchard to orchard and season to season; furthermore, a combination of strategies will evolve each season. This review has demonstrated that the UK approaches to fruit thinning, in comparison with world practices, are very similar. Although we may have fewer chemicals at our disposal than some nations, very similar challenges are experienced by growers all around the world.

It appears that UK growers are perhaps more wary about using mechanical thinners than overseas growers. This is borne out by the fact that just 16 Darwin machines have been sold in the UK. Trials both in the UK and overseas show very promising results and as we improve their use and investigate more about their long term effects, such machines are likely to prove to be cost effective options for our cooler climate.

In terms of chemicals, gaining approval for metamitron in the UK is an exciting prospect as it appears to be a less temperature dependent fruitlet thinner than alternatives whose efficacy can be adversely affected by low temperatures following application. Some research has investigated the use of salts and oils as thinning agents. These present opportunities for organic systems but they too can be influenced by temperature, humidity, crop growth stage and spray coverage, leading to unpredictable results. Commercial growers currently focus on gaining optimum results using products already available, either in combination or with adjuvants. They also use tools such as the MaluSim and Fruitlet Growth models to inform the timing of chemical fruit thinning applications and their rates of use.

A key objective of this review was to consider how different thinning techniques affect different apple qualities and in particular, storage potential. Following a wide literature search it became clear that little work has focused on this topic. The literature which cites fruit quality parameters such as firmness and Brix, offers some very mixed conclusions. When compared to hand thinning and no thinning, both mechanical and chemical thinning strategies demonstrated both positive and negative effects. With a desire in the UK to store apples (particularly Gala) for longer, it would be very valuable to understand these effects.

Recent work carried out for the HDC (Project TF 222), has highlighted the importance of dry matter content (DMC) for fruit quality. It is clear that further work needs to be carried out to demonstrate how practices such as thinning could affect fruit quality characteristics such as DMC. The majority of the evidence from literature suggests that the size of the crop load, rather than the way that crop load was achieved, will have a greater effect on crop quality

and storability. However claims have been made in more than one paper of improved fruit firmness and sugar content in both mechanically and chemically thinned fruit, suggesting that the method of thinning could influence storage potential.

Little or no research appears to have been done to assess the effect of different thinning techniques on the long term health of trees. Anecdotal evidence from growers using mechanical thinners around Lake Constance in Germany has so far not shown any long term detriment. However further work will need to be done in this area comparing methods to ensure that growers are not compromising future crops by thinning in certain ways.

Overall, this review has highlighted how complex apple thinning is and how many different factors are involved in determining the effectiveness of selected thinning strategies. In the UK, a variety of tools and options are available to growers; integrating their use to achieve optimum marketable fruit yield is the next step. This review has further demonstrated the potential of mechanical thinning and identified some new chemistry which may offer future potential in the UK. It has also highlighted some models developed in the USA to help growers reduce the uncertainty of chemical thinning, both in terms of when to thin, chemical concentrations to use and how effective thinning may have been according to the environmental conditions. Development of these types of models for UK systems and conditions would help to target the timing and likely impact of using selected thinning techniques on productivity. Their use alongside imaging technologies to inform optimum winter pruning strategies, alongside integration with mechanical techniques, would take some of the uncertainty out of the process of thinning and hopefully improve efficacy and cost effectiveness.

More comprehensive information gathered from this review is set out in the main Science section of this report. This includes information on fruit quality, the effect of crop load, methods to achieve the correct crop load, hand thinning, mechanical thinning, the timing of thinning and the effect of thinning on fruit quality, storability and tree health. Details are also included on chemical thinners, mechanical thinners, models, shading, imaging technologies and cost comparisons of different thinning systems.

Recommendations

Through the course of this review it became clear that tree fruit thinning is a complex and highly variable process; there is no single approach that can be applied to all crop types to achieve optimum tree fruit thinning. Current methods have their limitations and there are gaps in our knowledge and understanding of how current thinning methods work and what

type of effect these methods could be having on fruit quality and tree health. We therefore recommend the following research themes for future studies to try to address the uncertainties associated with thinning and support the UK industry to thin more effectively and consistently:

1. A targeted comparison of commercial growing practices, including thinning, to identify those having greatest impact on the fruit storage potential of Gala and Braeburn;
2. Fully replicated trials comparing thinning methods and the effects on fruit storage ability. These should be compared with hand or no thinning controls. Methods to include mechanical, chemical and combined approaches;
3. Physiological study of Gala looking at components of yield and fruit storage ability;
4. Develop Precision Crop Load Management tools for the UK, using the MaluSim and Fruitlet Growth models to inform chemical fruit thinning and achieve optimum results;
5. To keep up to date with the newest chemistry, theories on adjuvants and tank mixes as well as more novel approaches, the UK needs a representative on the EUFRIN group, which is at the forefront of thinning research in Europe;
6. Experimental work to identify optimum use of combinations of chemical thinners - those currently available, likely to become available and novel treatments with and without adjuvants, under UK conditions;
7. Review longer term effects of mechanical thinning techniques on tree health – a study tour to gather information from regions where mechanical thinning has been used widely over several seasons;
8. Experimental comparison of mechanical thinning equipment - the Darwin system, the BAUM/Bonner and others available on the market for different growing systems;
9. Investigate the potential of shading as a thinning strategy in the UK;
10. Investigate spray application techniques – assess if chemical thinning using products such as ATS, which require good contact with the centres of flowers, can be improved through changes in volume or nozzle technology;
11. Update the HDC Apple Best Practice Guide thinning sections based on the findings in this review and develop this into a smart phone friendly format. Provide timely updates with links to best practice advice at key thinning milestones through the season.

Financial comparisons

A cost comparison of currently utilised methods has been produced as part of this review and is detailed below. This excludes machinery costs and assumes that the thinning

efficacy of all approaches is adequate. This is not commonly the case and further applications or greater amounts of hand thinning may be required.

Scenario	Method	Frequency	Number of people-hours required to thin 1 ha	Total cost per ha
1 - Use of chemical blossom thinner followed by hand thinning as required	ATS	3	0.5	£1,657
	Hand	2	175 (125 hrs for first lot of hand thinning and 50 hrs for second lot)	
2 - Use of a mechanical blossom thinner followed by hand thinning as required	Mechanical	1	1.25	£1,291
	Hand	1	150	
3 - Purely hand thinned	Hand	2	250 (assuming each hand thin took 125 hrs)	£2,125
4 - Combined chemical blossom and fruitlet thinner	ATS	1	0.5	£689
	BA	1	0.5	
	Hand	1	50	