# New research into post-harvest quality of apples and pears (TF225)

Richard Colgan (NRI-UoG)
Julien Lecourt (NIAB-EMR)

# Tree Fruit Quality Consortium

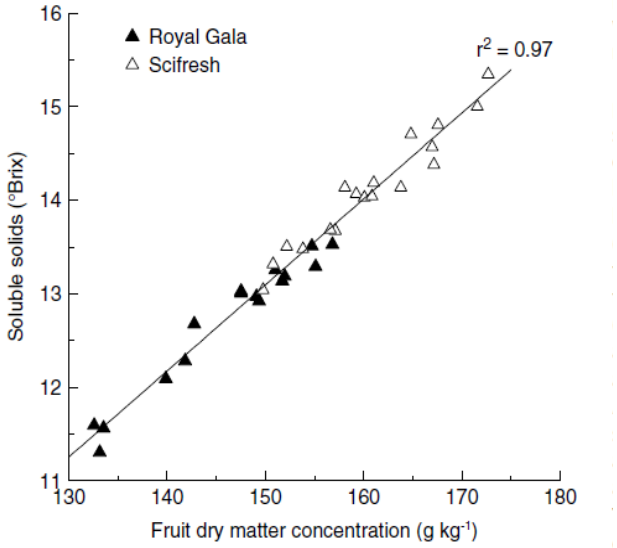
- NRI-UoG Meta Analysis and Carbohydrate analysis (Chris Atkinson, Debbie Rees & Richard Colgan)
- NIAB-EMR Tree fruit Architecture- improvement in light penetration (Julien Lecourt)
- Fast LLP- Fruit thinning (Abi Dalton, Tim Biddlecombe)
- Landseer Ltd. Chlorophyll Fluorescence – (Mehrdad Mirzaee, Mark Tully, Colin Carter)
- Grower Advisory Board: Nigel Jenner , Nigel Stewart, Nigel Kitney and Paul Smith.

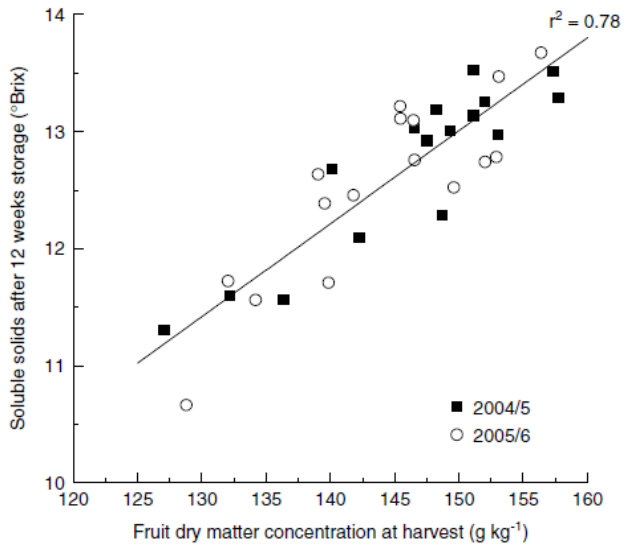
# How do we influence the taste of apples

- Consumer eating experience is driven by the sweetness, crispness, tartness and flavour of fruit.
- Apple taste: a balance between sweetness and acidity, with ample flavour volatiles.
- Apples that lack sweetness or acidity - inferior in eating quality even when sufficient flavour volatiles are present.
- Sweetness linked to accumulation of Dry Matter (DM)
- Improved consumer preference for apples with high DM – (Harker et al 2003)

# Increasing Dry Matter (DM) improve the sweetness (% Brix) of apples

- Strong relationship between DM content at harvest and % Brix
- DM content at harvest has been used to predict % Brix coming out of store (max- 3 months)- (Palmer et al 2010)




John Palmer *et al* 2010

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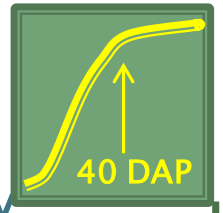
Natural Resources Institute

# Can we manipulate DM during fruit growth?

**Phases of growth:**
- cell division
- cell expansion

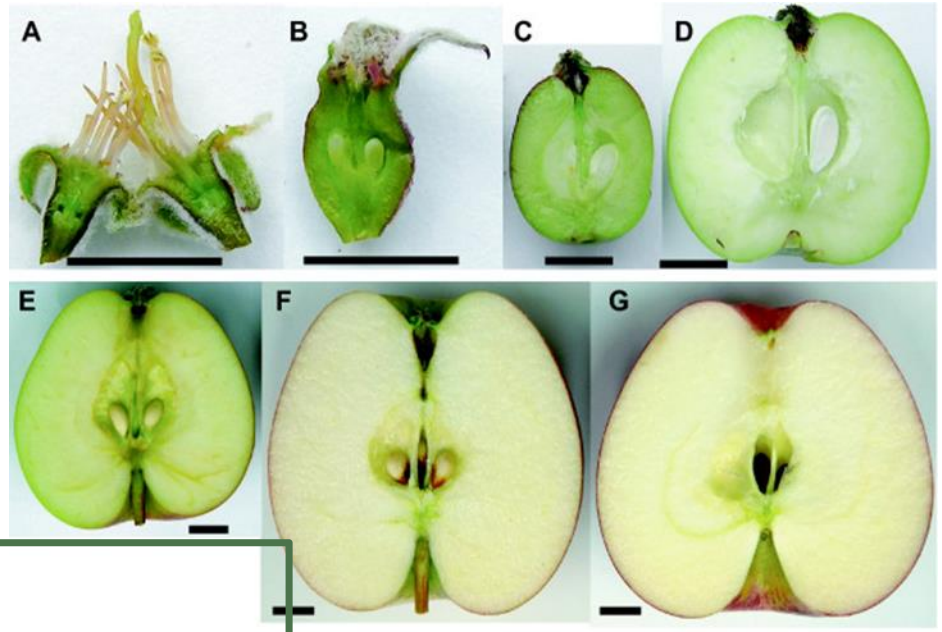
Cell No.



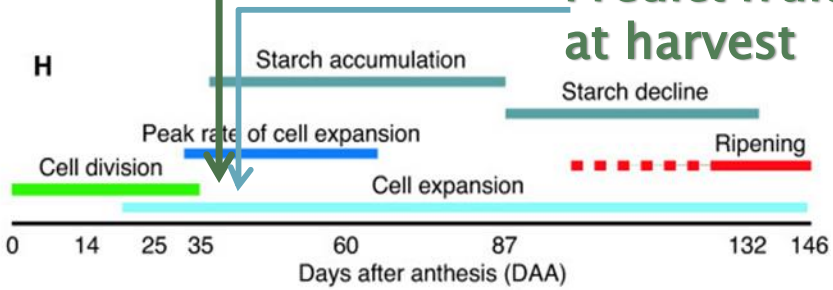

Cell division genetically determined – influenced by fruit thinning

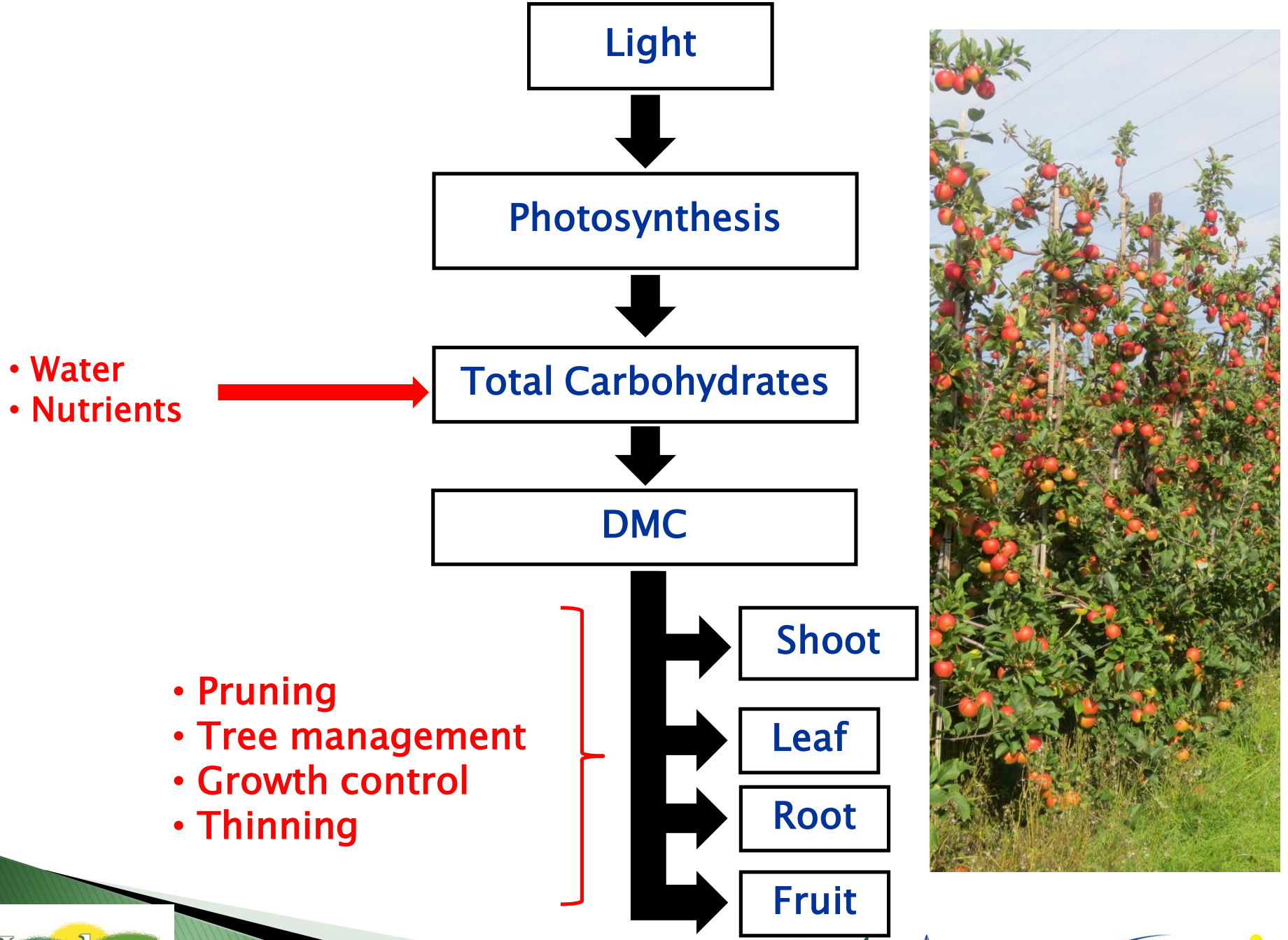
Cell expansion, final cell size, and fruit size – strong environment influence

Cell expansion driven by fruit sugar accumulation & water uptake –




Predict fruit size at harvest





# WP3: Determine impact of & develop recommendations for thinning strategies on quality & DMC (FAST/NRI)

## Year 1

- Track DM through season in well lit and shaded parts of the canopy

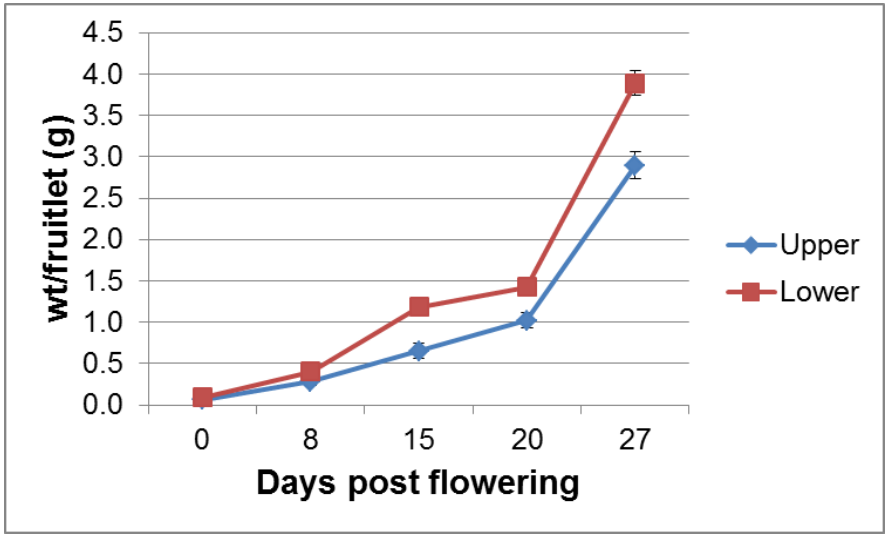
## Years 2-4

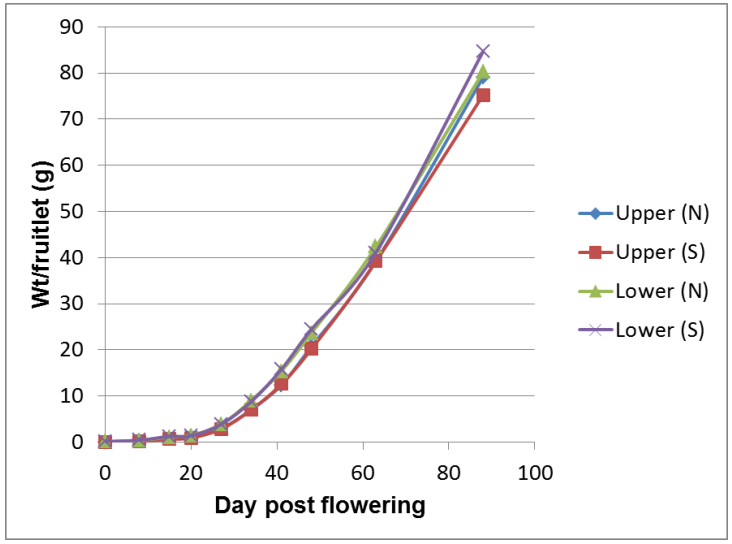
- Compare different thinning timings to prove a positive and negative effect on DM

## Years 4-5?

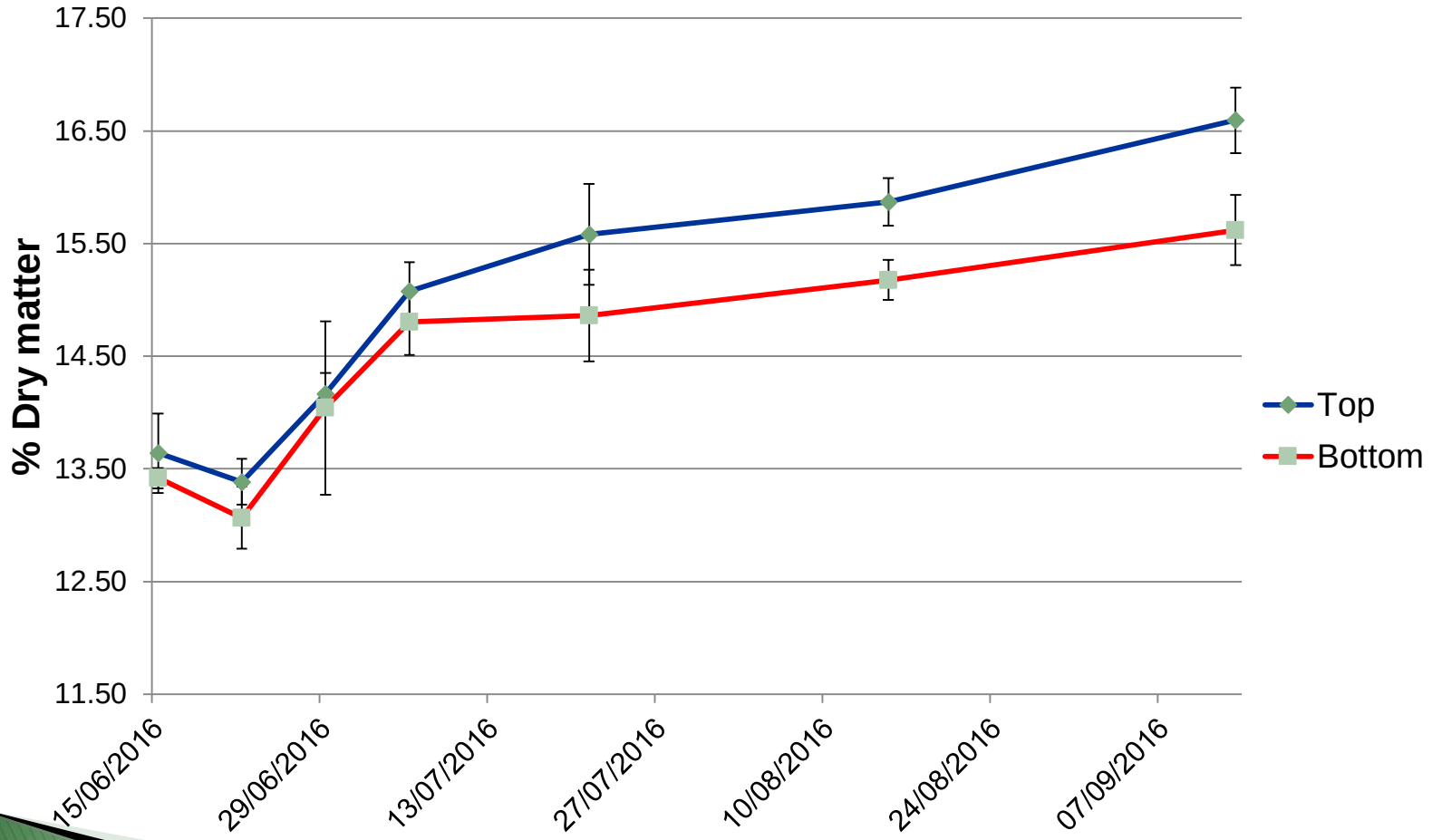
- Effect of crop load at optimum thinning time

# Positional Effects on Initial Growth Rates of Gala Fruitlets

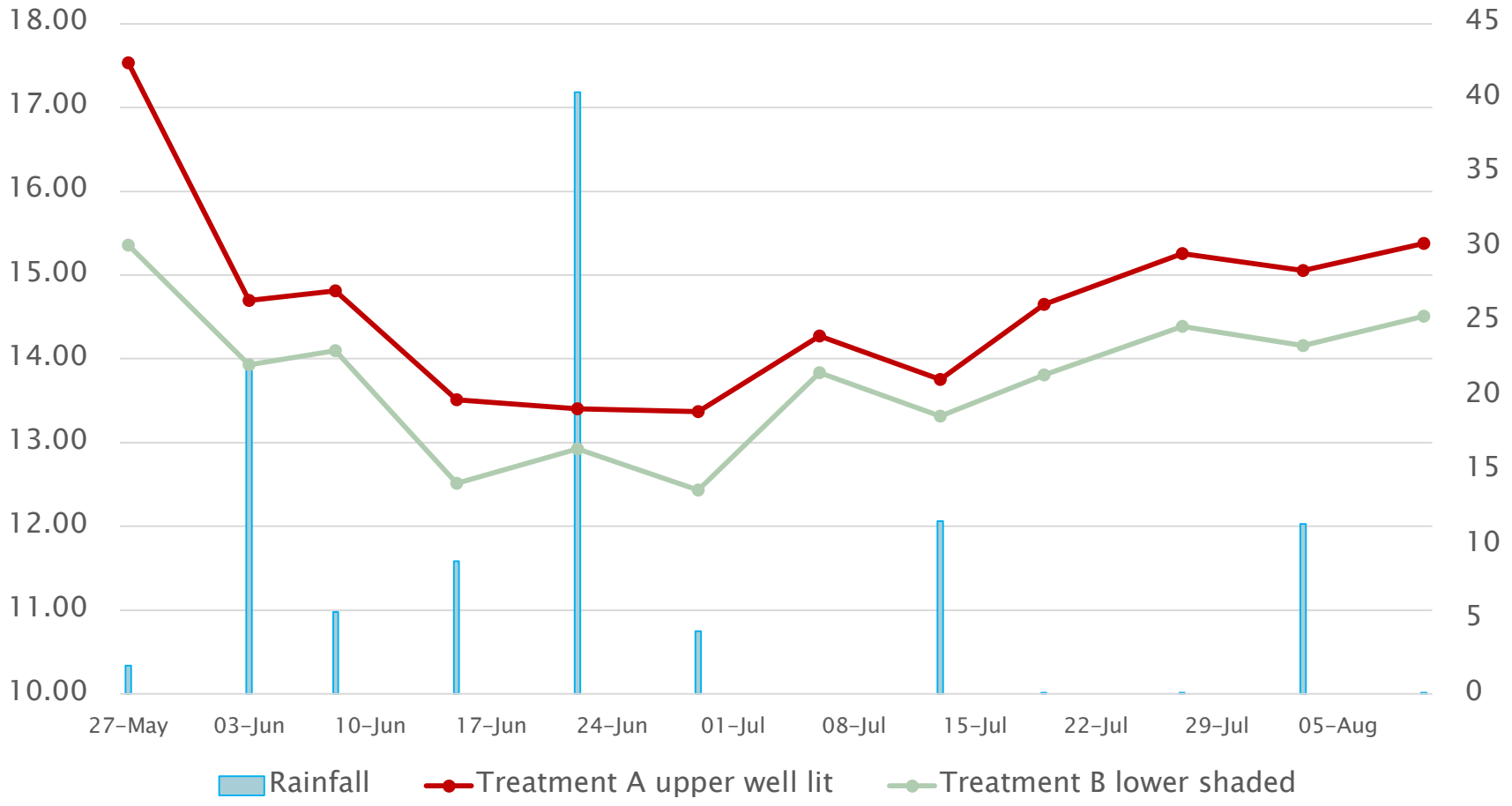


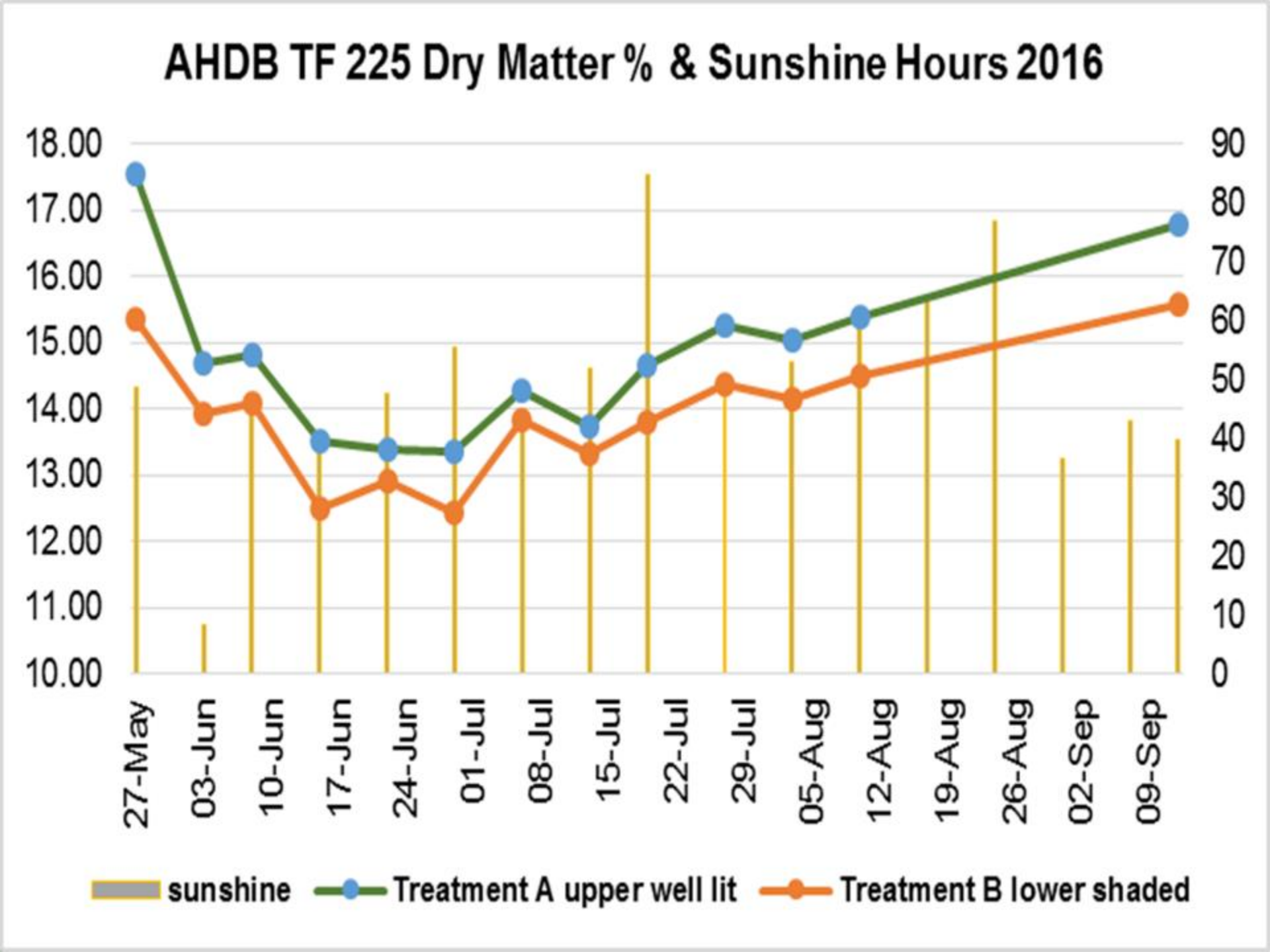



# The rate of Dry Matter increase between Gala growing in high and low canopy



# Dry Matter % + Rainfall Events 2016




AHDB TF 225 Dry Matter % & Sunshine Hours 2016
18.00
17.00
16.00
15.00
14.00
13.00
12.00
11.00
10.00
90
80
70
60
50
40
30
20
10
0
27-May
03-Jun
10-Jun
17-Jun
24-Jun
01-Jul
08-Jul
15-Jul
22-Jul
29-Jul
05-Aug
12-Aug
19-Aug
26-Aug
02-Sep
09-Sep
sunshine
Treatment A upper well lit
Treatment B lower shaded

# Proposed Thinning Treatments 2017-2021

- No thinning (control)

Hand Thinning

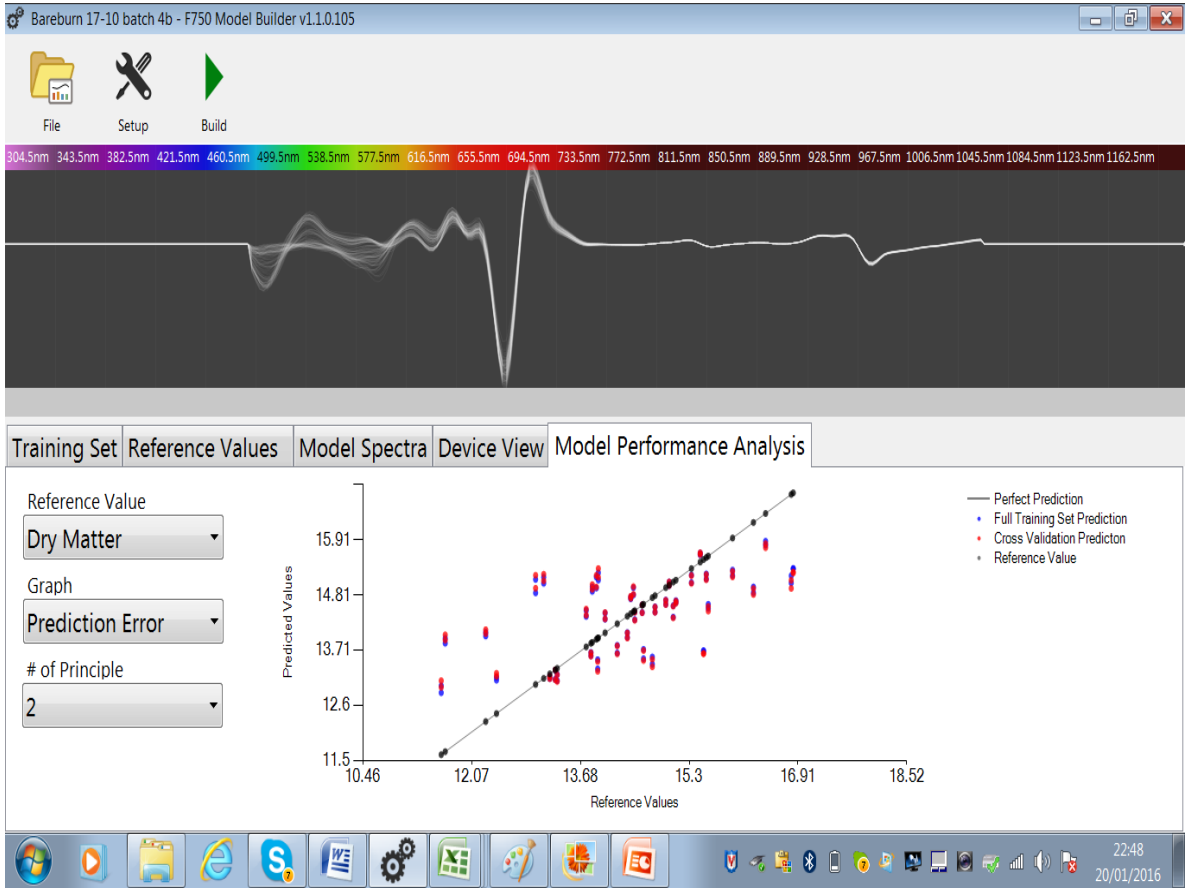
- Standard. – pre/during 2nd fruit fall: 20 -30mm (BBCH 72-73)
- Late – after second fruit fall up to 40mm (BBCH 74)
- Fruit removal below set size: (BBCH 71-72).

Chemical

- Exilis 6-Benzyladenine (funded by Fine) (BBCH 70-72)
- Brevis 150 SG metamitron 15% (funded by Adama) (BBCH 70-71 & 71-72).

Mechanical thinning- hand held – 60% first open flower (BBCH 65)
Bud thinning – via late pruning using MAFCOT Equilifruit tool to gain optimum buds per branch diameter (BBCH 55-59)

# Non destructive prediction of DM using (NIR)– Felix 750




# WP4 Validating Chlorophyll fluorescence to predict optimal harvest of Gala for long-term storage

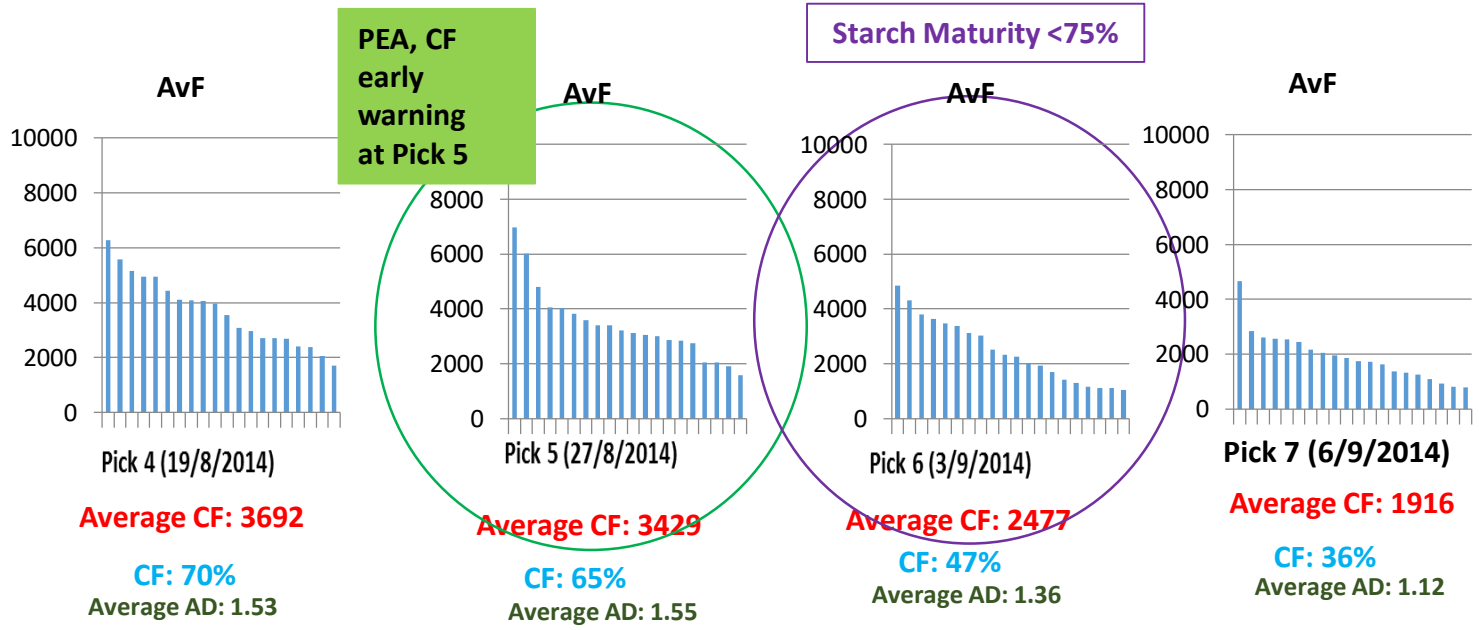
- Relationship of Chlorophyll fluorescence (CF) and Chlorophyll content with fruit maturity and DMC content of Gala.
- Using CF to predict harvest date.
- Gala from 6 orchards +/- SmartFresh$^{SM}$
- stored at 5/1 and under DCA conditions.

# Stage 3: Harvesting samples from each target orchard on two picking dates

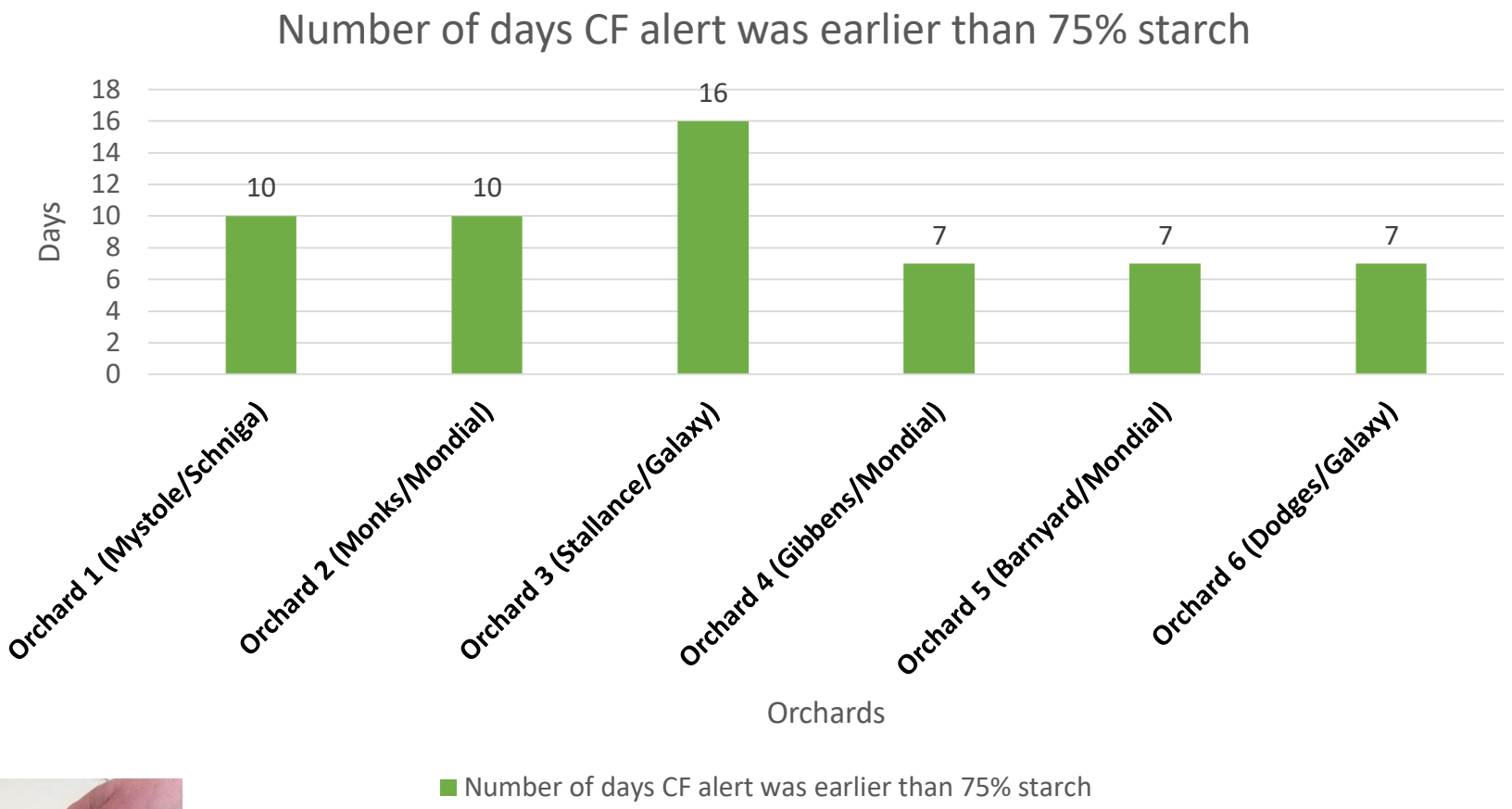
In this stage by analysing data:

- At CF warning there would be 7 days time to pick the fruit.
- At starch maturity warning, there would be 3 days time to pick the fruit.

Example from previous trials:



# Comparison of Pocket PEA with Starch maturity test




Pocket PEA

**CF warning (pocket PEA) as average was 7-10 days earlier than 75% starch**

# Light interception

- ‘Improving light interception to increase orchard profitability’

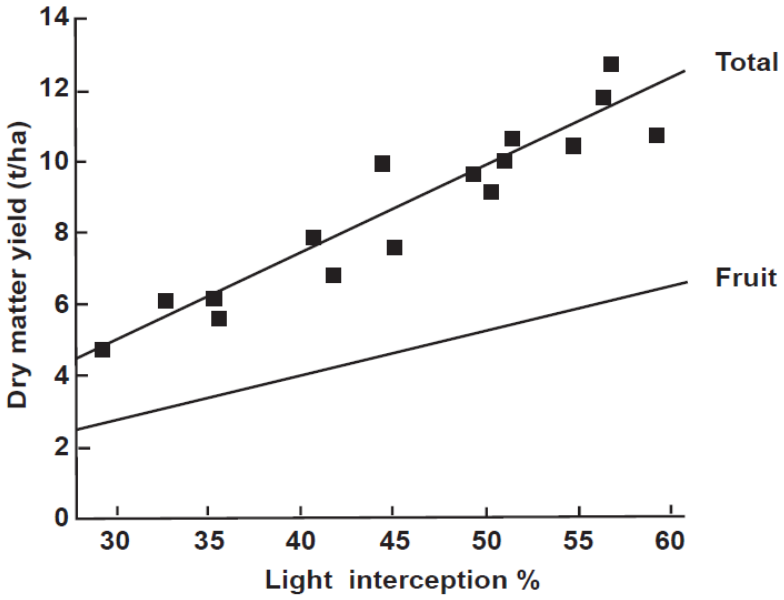
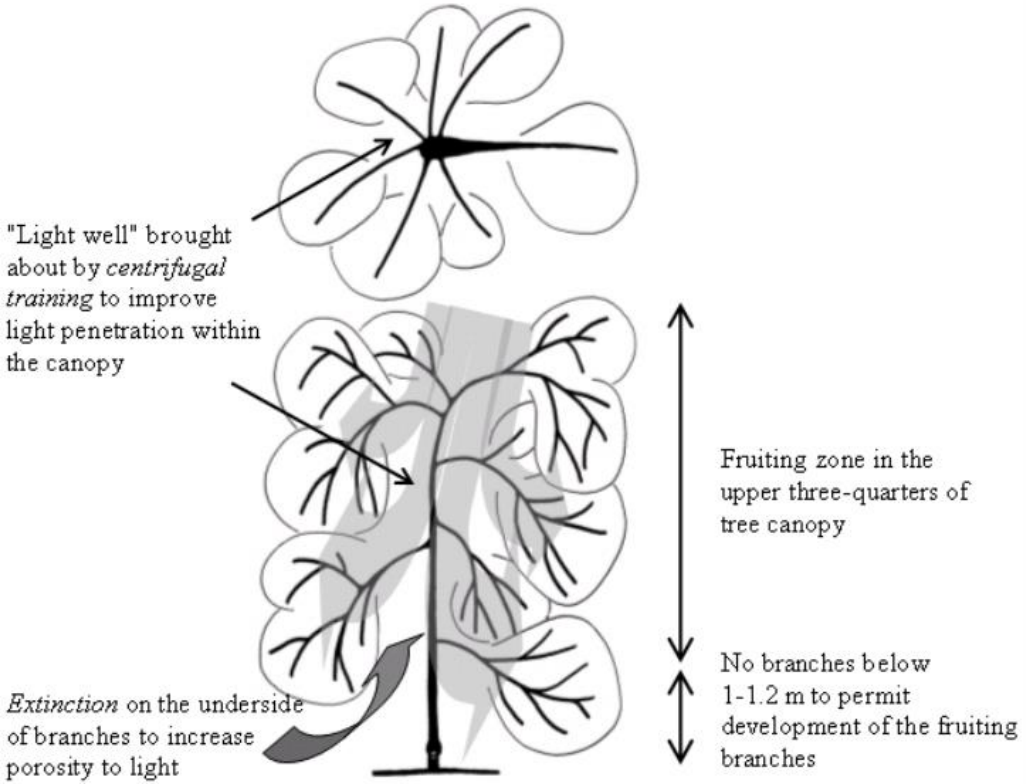



Figure 2. Relationship between light interception and total dry matter production and yield of fruit of Golden Delicious/M.9 at East Malling.

- Improved BRIX and colour
- Improved uniformity
- Improved storage capacity
- Reduced P&D pressure

# Methods – Centrifugal training




# Methods – Reflective ground covers

# Treatments

- Treatments

- Tall spindle (TS) and centrifugal (CENT)
- Reflective ground covers

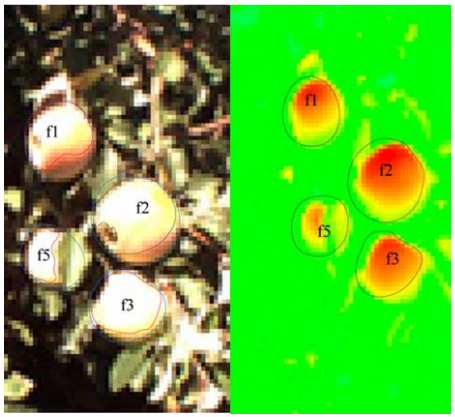
| **Training system** | TS | CENT | TS | CENT |
|---|---|---|---|---|
| **Reflective Covers** | - | - | + | + |

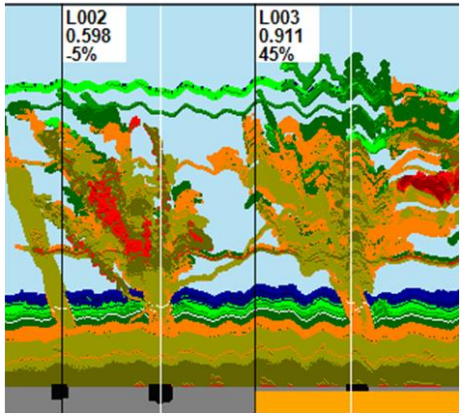
Light levels

# Measuring light environment

- Measurements (light environment)

- LiDAR scan of the orchard (canopy characterisation)
- ACCUPAR within the canopy at 3 different levels
- Thermal imaging
- Quality assessments by NRI




# Acknowledgements


- AHDB-Horticulture for funding the work programmes (TF225)
- Mr David Figgis – use of Gala orchard and providing fruit