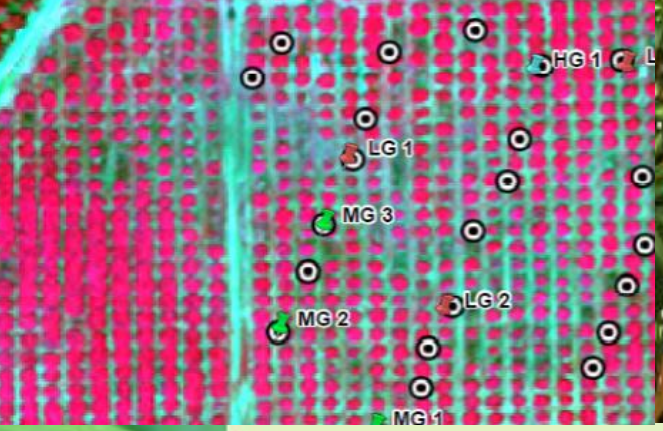
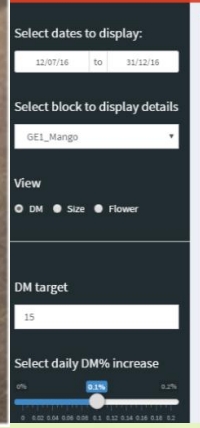






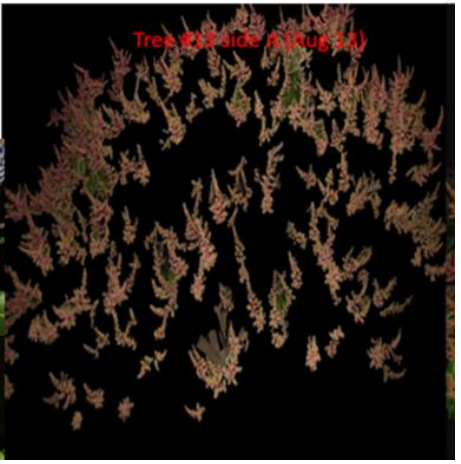
Multiscale monitoring

Kerry Walsh,

Zhenglin Wang, Phul Subedi, Nick Anderson, Anand Koirala

Ryan Lerud

AMIA, May 2017



Tasks:

- slashing (mapped orchard)
- pruning (mapped orchard)
- selective spraying and amount of spray
  (flower mapping, tree condition monitoring, canopy density)
- selective harvest (flower mapping)
- counting, yield maps, identify elite trees over years
  (fruit localisation)
- harvest maturity (heat sums, fruit DM assessment)
- data management/display
- (automated harvest)

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25% canopy in flower

Machine vision in estimation of flowering

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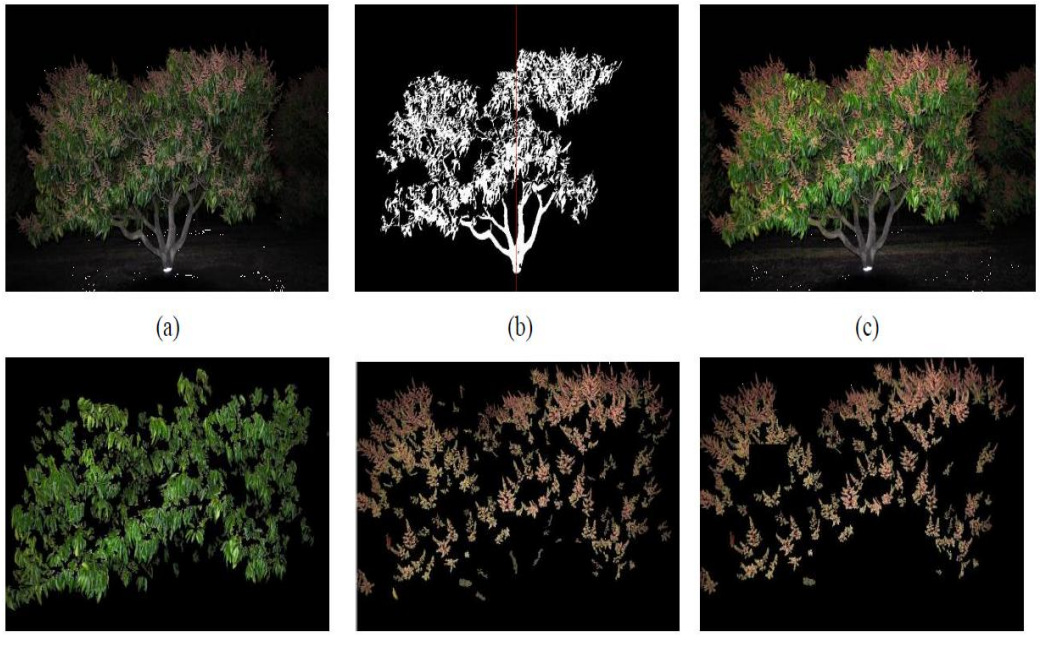
100% canopy in flower

MV: Automated Flowering Assessment

Potential applications:

- harvest of individual mango trees (from order of tree flowering);
- Inform crop agronomy (e.g. variable rate spray, with no chemical spraying for non-flowering trees);

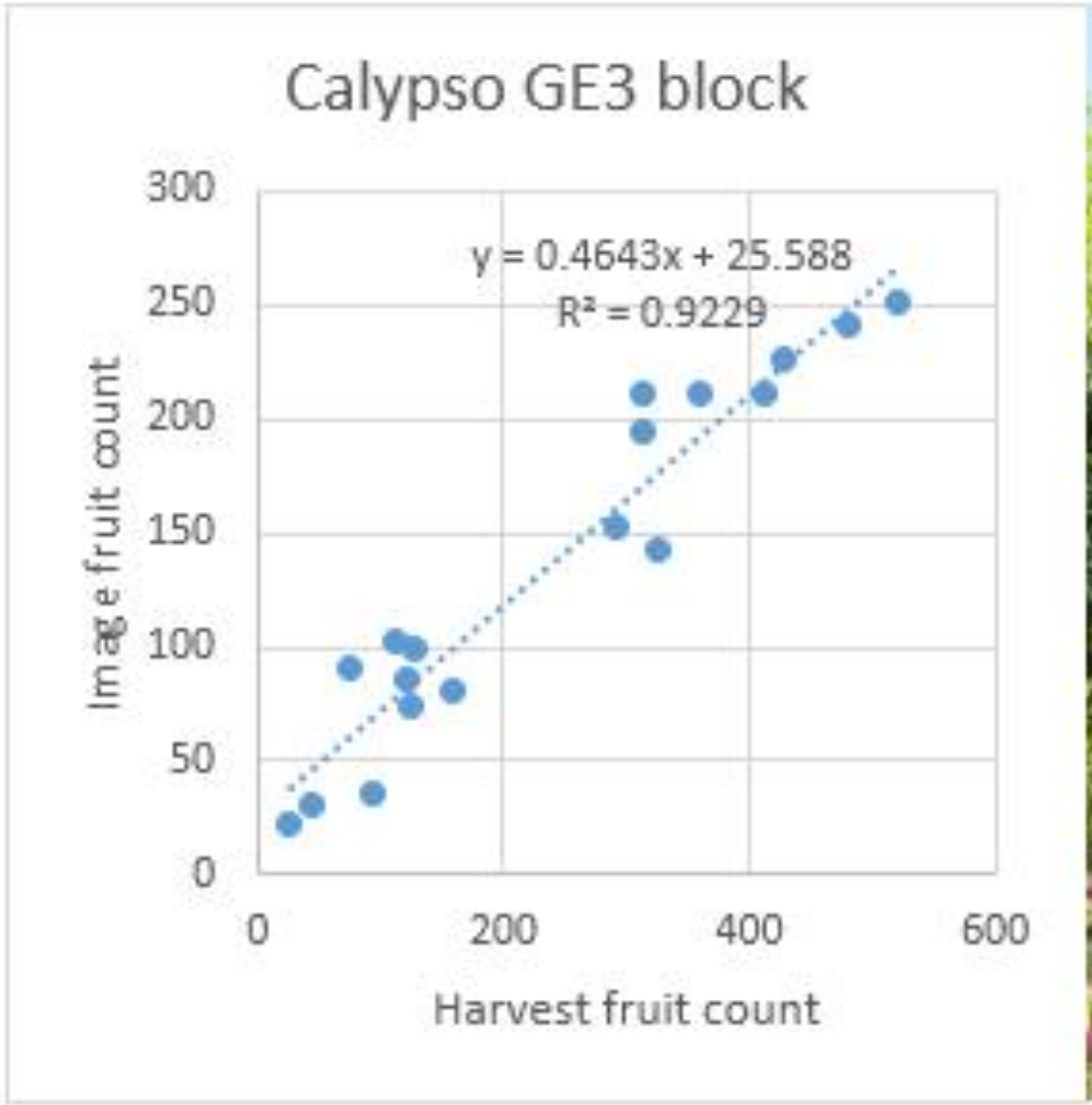


Machine vision for fruit detection

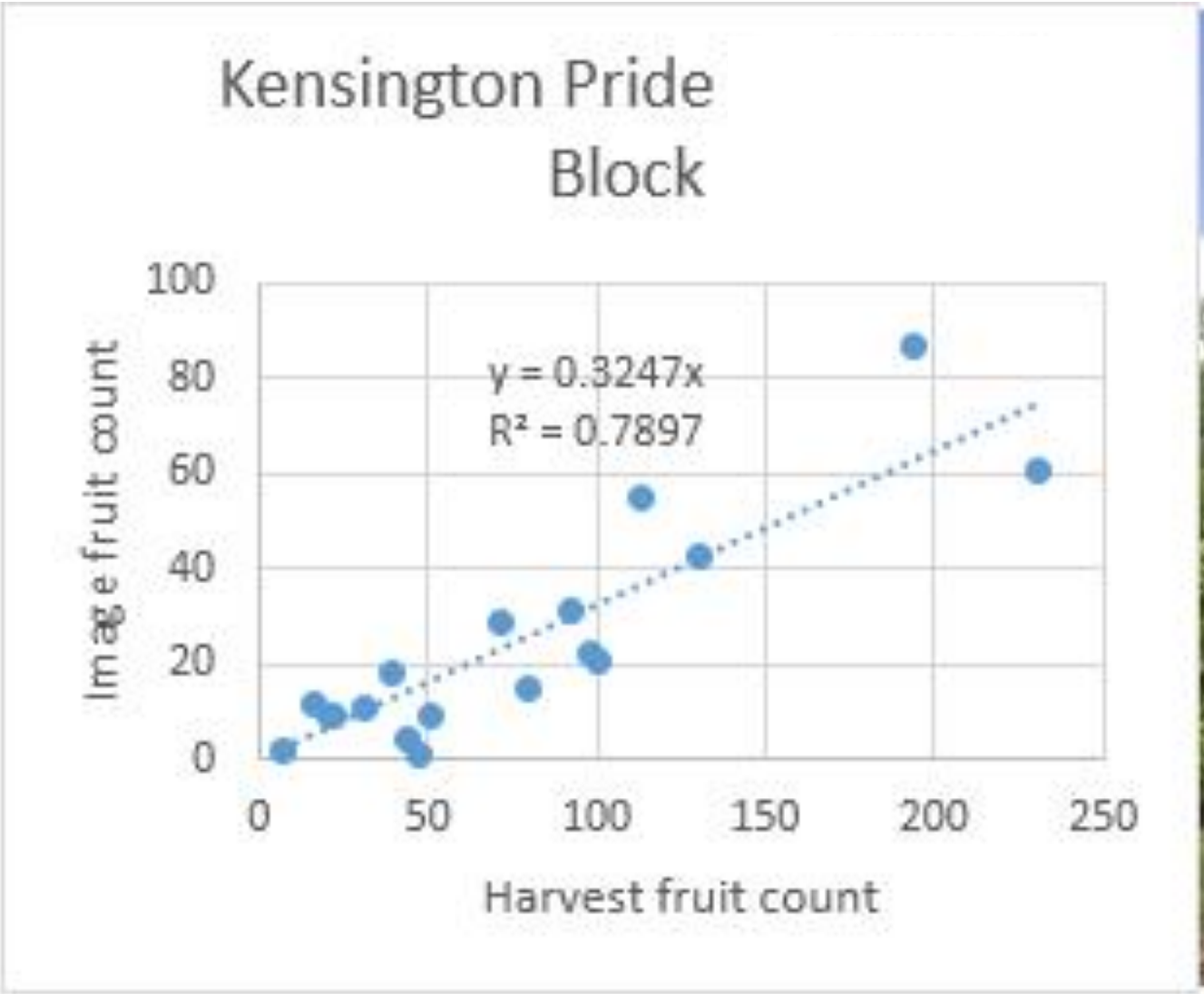
for :

- fruit count

- eventual autonomous harvest



Average ratio image count to harvest count = 0.64 i.e. 36 % fruit hidden



Average ratio image count to harvest count = 0.32 i.e. 68 % fruit hidden

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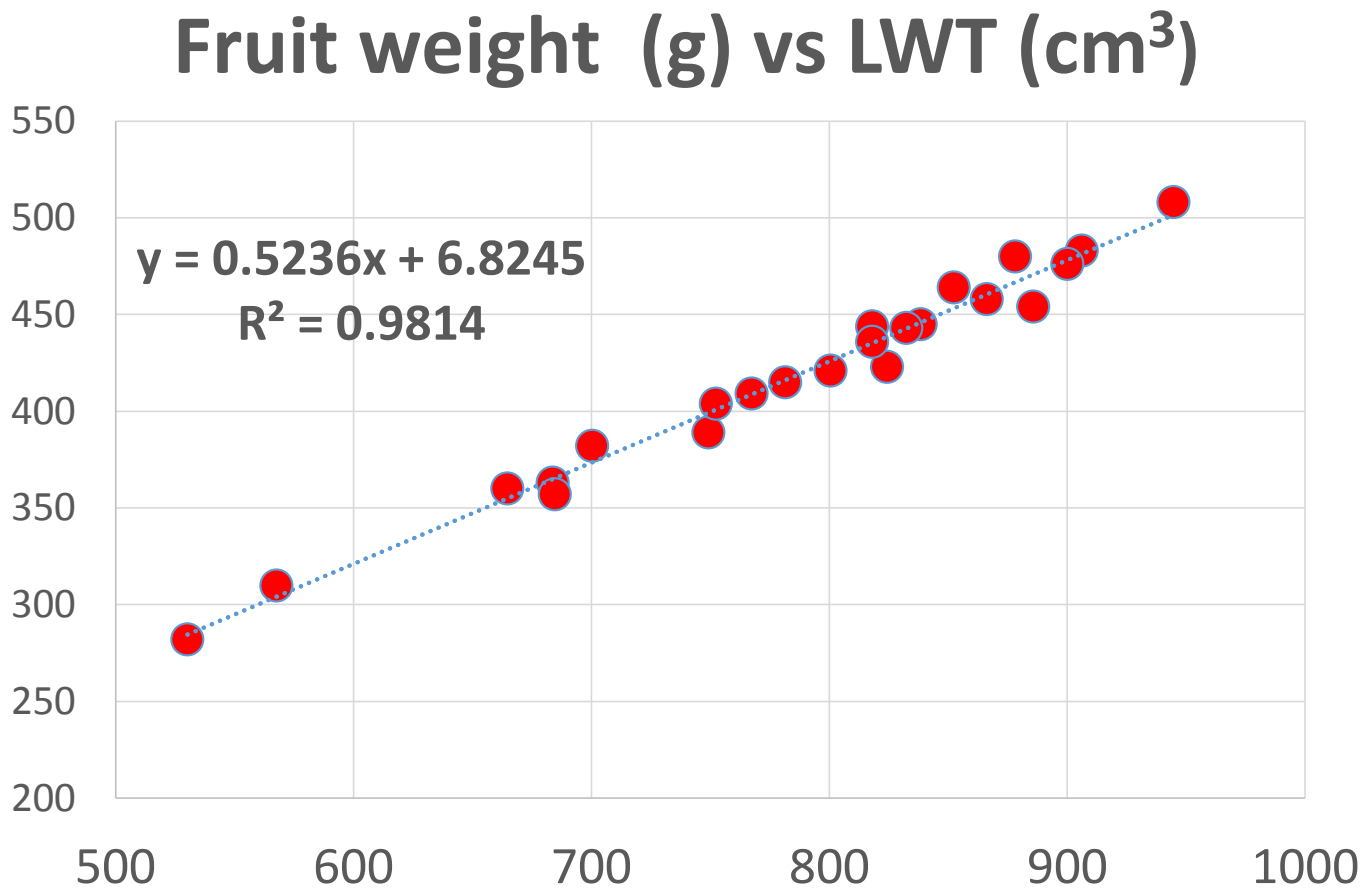
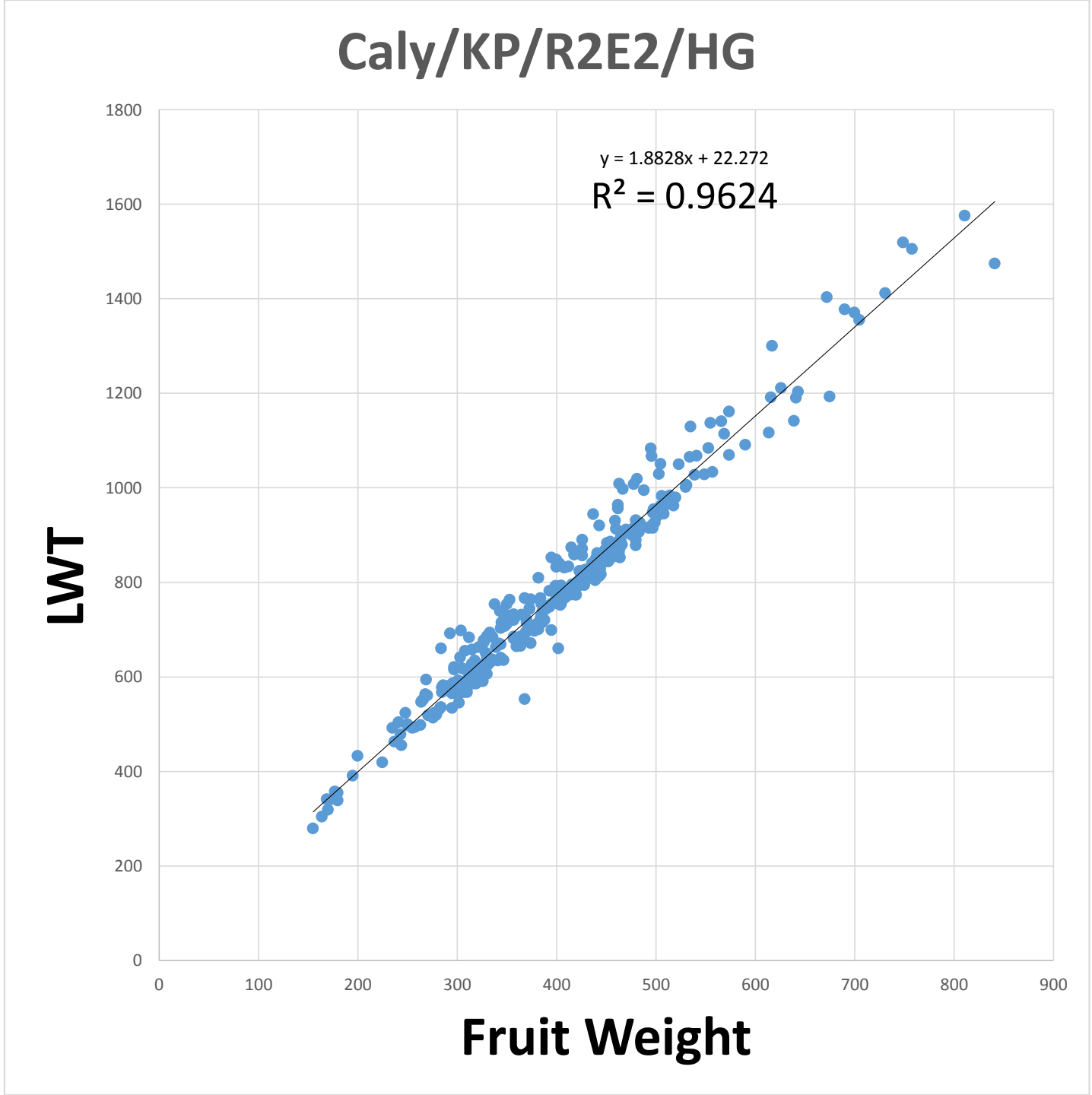
Fruit weight is related to fruit volume (by variety)



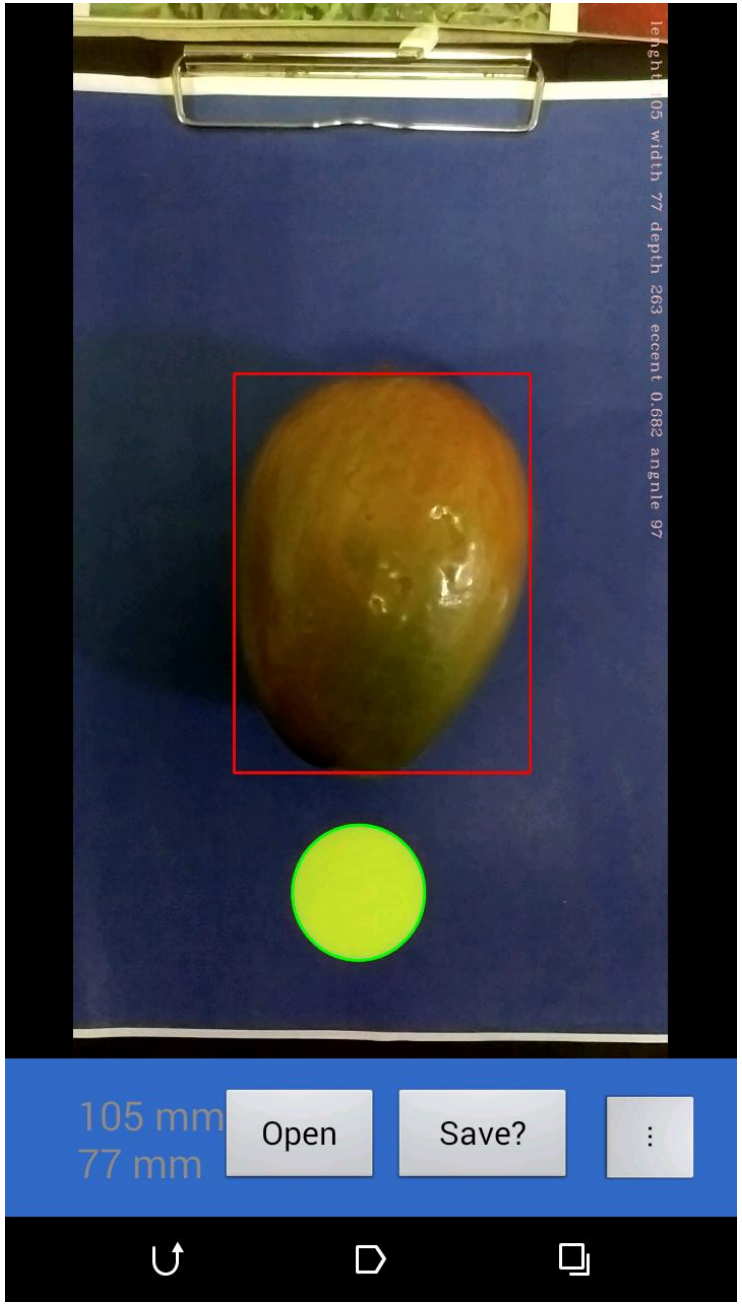

Caly/KP/R2E2/HG
y = 1.8828x + 22.272
R² = 0.9624
LWT
Fruit Weight
0
200
400
600
800
1000
1200
1400
1600
1800
0
100
200
300
400
500
600
700
800
900

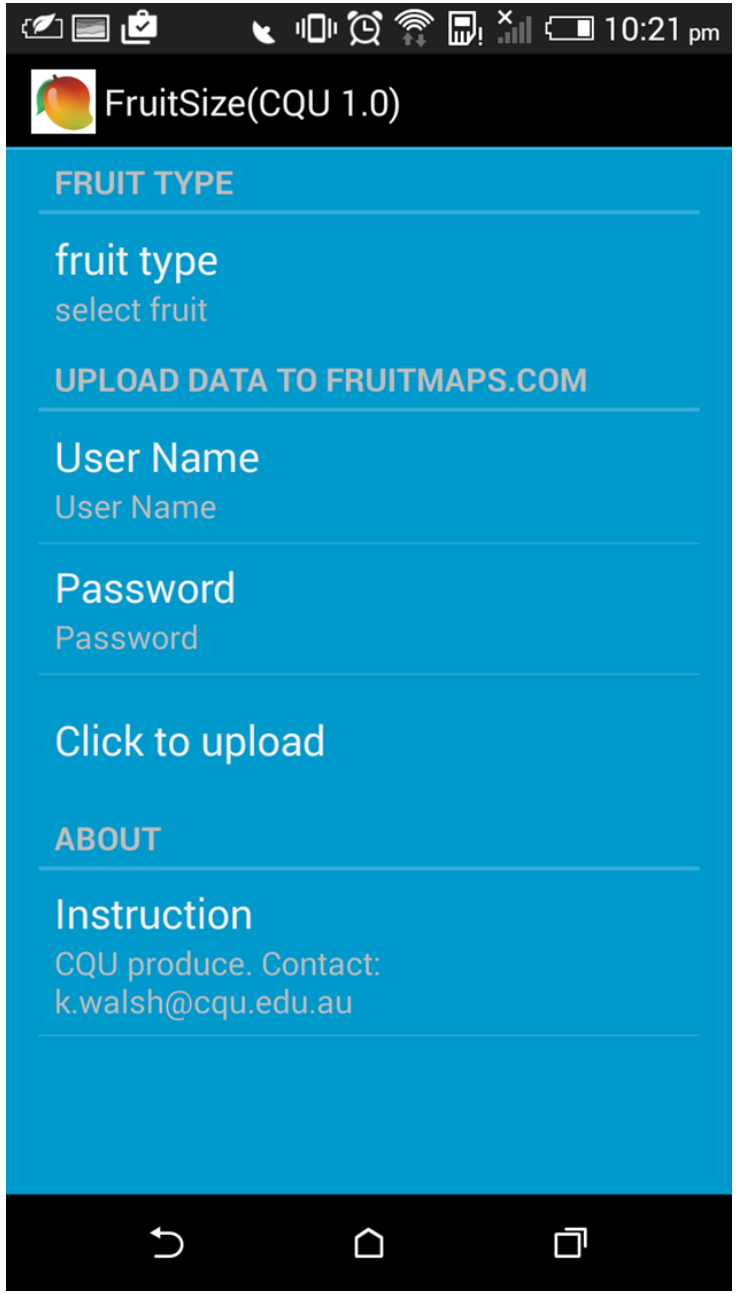
on-tree fruit size with ToF camera

Issues:

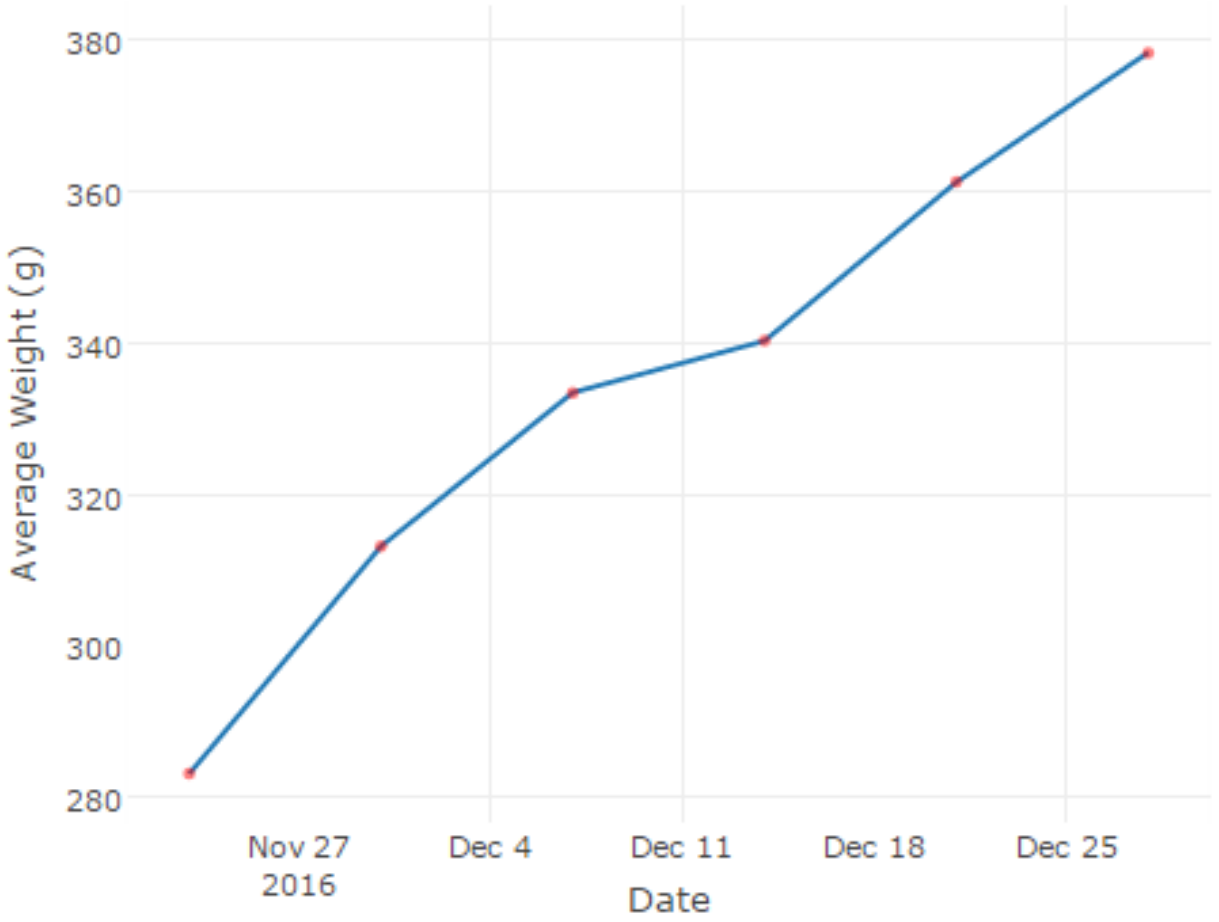
- cost
- night imaging
- occlusion of fruit size estimation to ca 5 mm

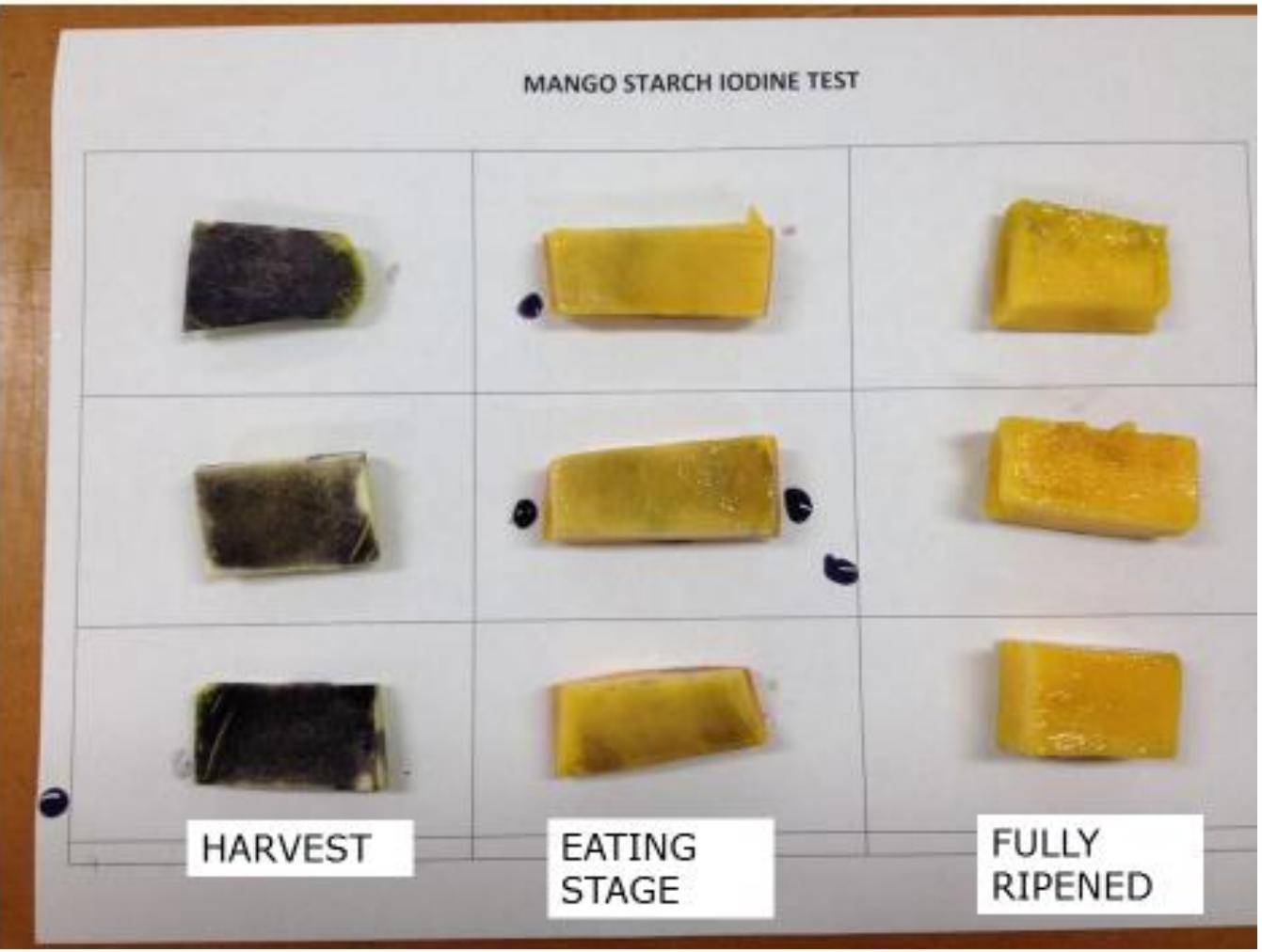
a mobile phone app to measure fruit size (& weight)


length 105 width 77 depth 263 eccent 0.682 angle 97
105 mm
77 mm
Open
Save?
:


10:21 pm
FruitSize(CQU 1.0)
FRUIT TYPE
fruit type
select fruit
UPLOAD DATA TO FRUITMAPS.COM
User Name
User Name
Password
Password
Click to upload
ABOUT
Instruction
CQU produce. Contact:
k.walsh@cqu.edu.au

Rate of increase: 2.6 g/day



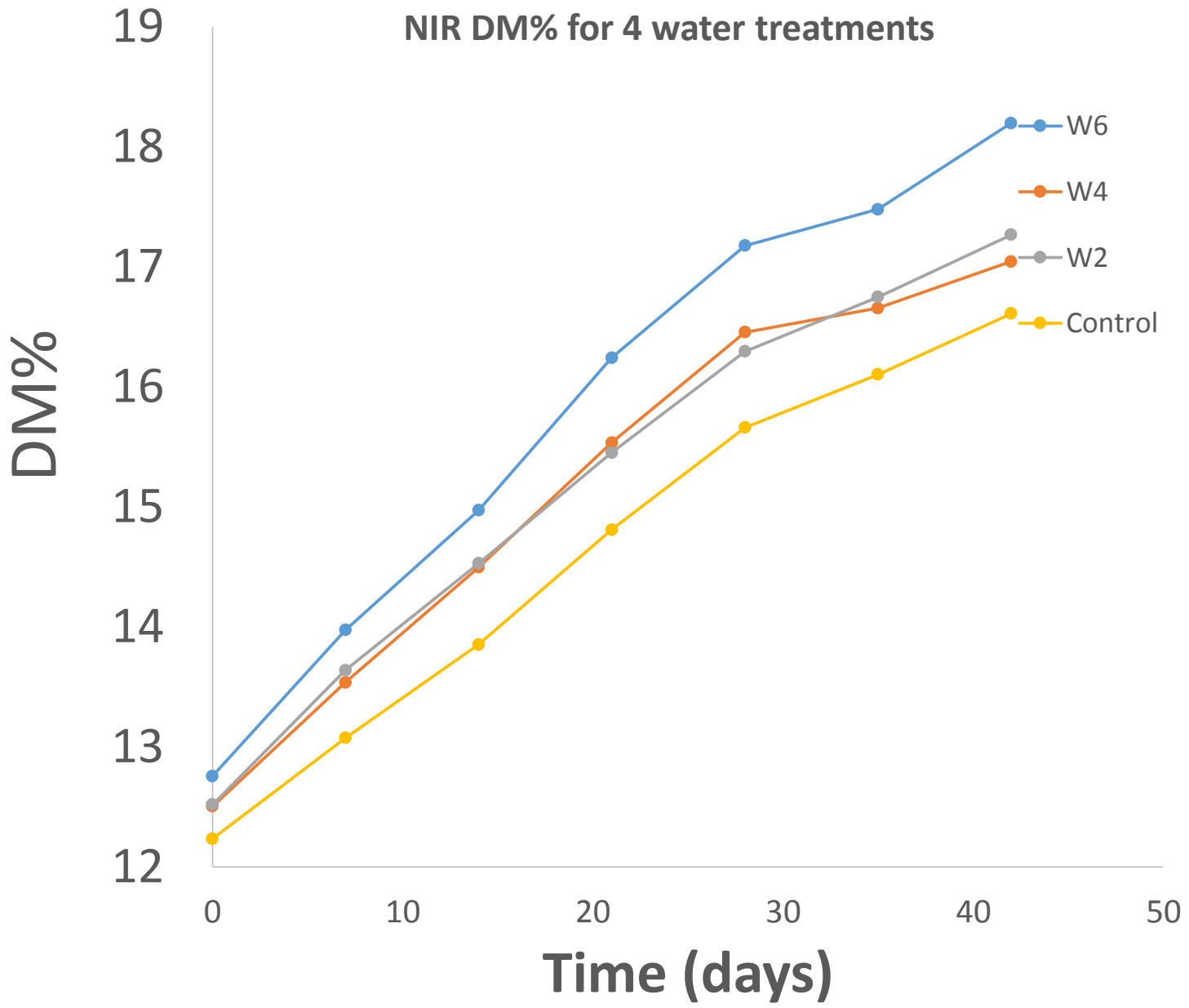


Dry matter

>15%DM for > 14 Bx
for **eating quality** (KP, Calypso)

%DM to index **harvest maturity**
(depends on growing conditions)


NTEA 01



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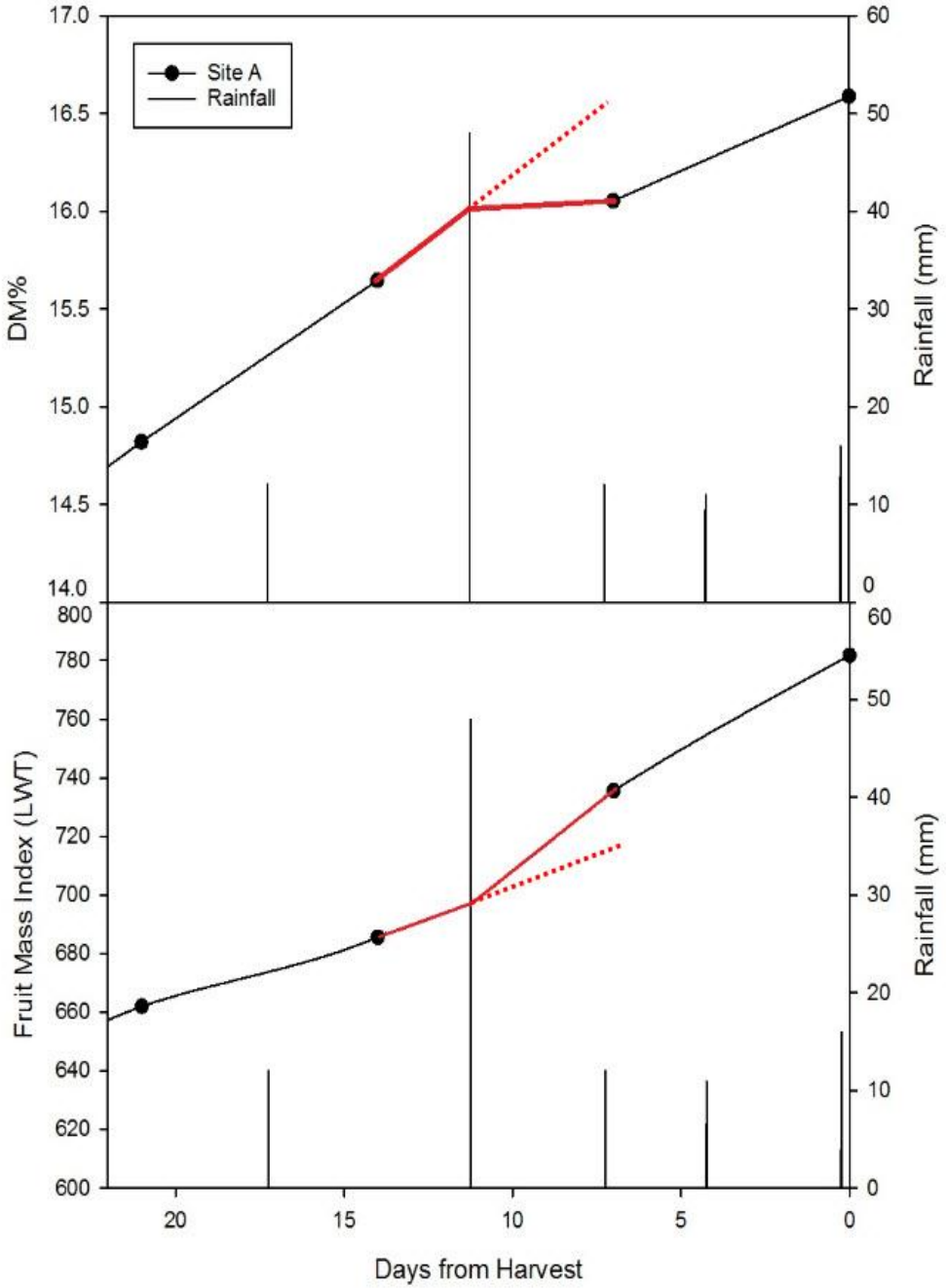
the effect of a rain event….

2015



Agronomic manipulations to increase DM%

Thinning improved DM%, however yield was dramatically decreased.

Girdling lacked an effect, data not shown.

Water denials of 2, 4, and 6 weeks increased DM%, without an impact to fruit size.

Water denials of 8 and 10 weeks greatly increased DM%, however decreased yield; data not shown.

Harvest DM% is variable between seasons and growing districts.

Recommendation – a water denial treatment of 2-4 weeks before harvest can improve eating quality.

Harvest DM%					
Treatment	**Trial 1**	**Trial 2**	**Trial 3**	**Trial 4**	**Trial 5**
Control	15.5	17.7	18.8	17.1	16.5
Thinning	17.0				
Water denial - 2 wk					17.6
Water denial - 4 wk		19.4	18.8		17.2
Water denial - 6 wk			19.4		18.3

a management support tool….

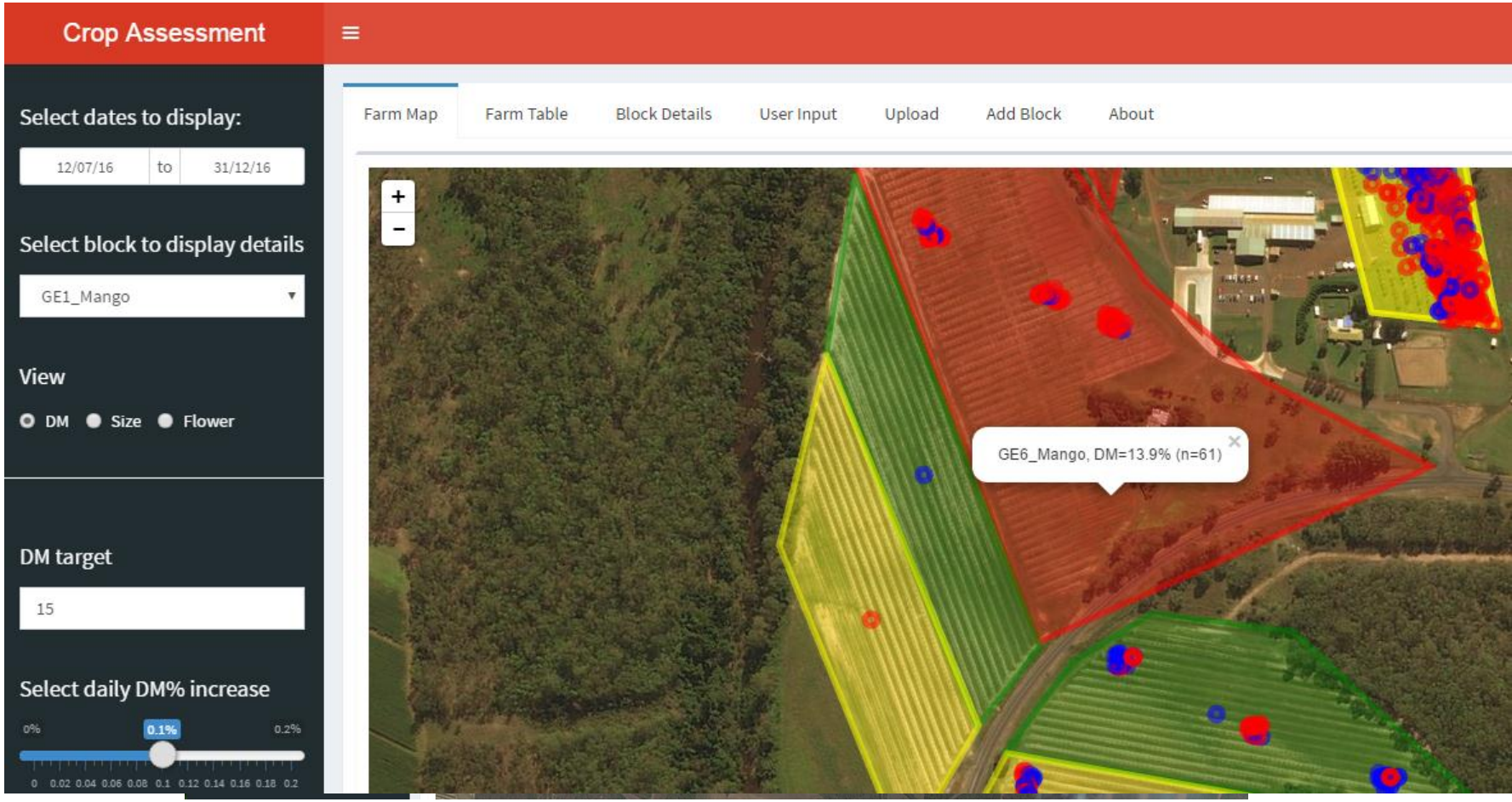
https://www.fruitmaps.com

Harvest maturity estimated by:

1. Flowering date
2. Heat units
3. Fruit size
4. DM

Crop yield from:

1. In field counts
2. MV



Crop Assessment

≡

Select dates to display:

12/07/16 to 31/12/16

Select block to display details

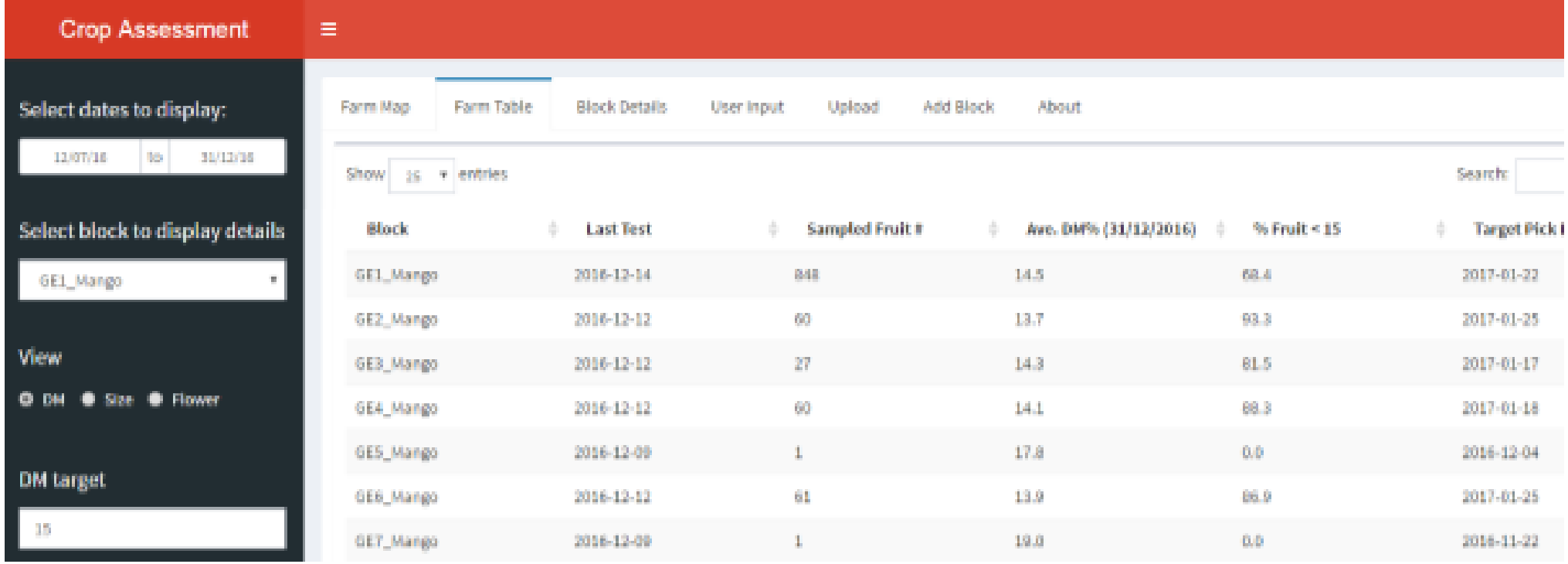
GE1_Mango

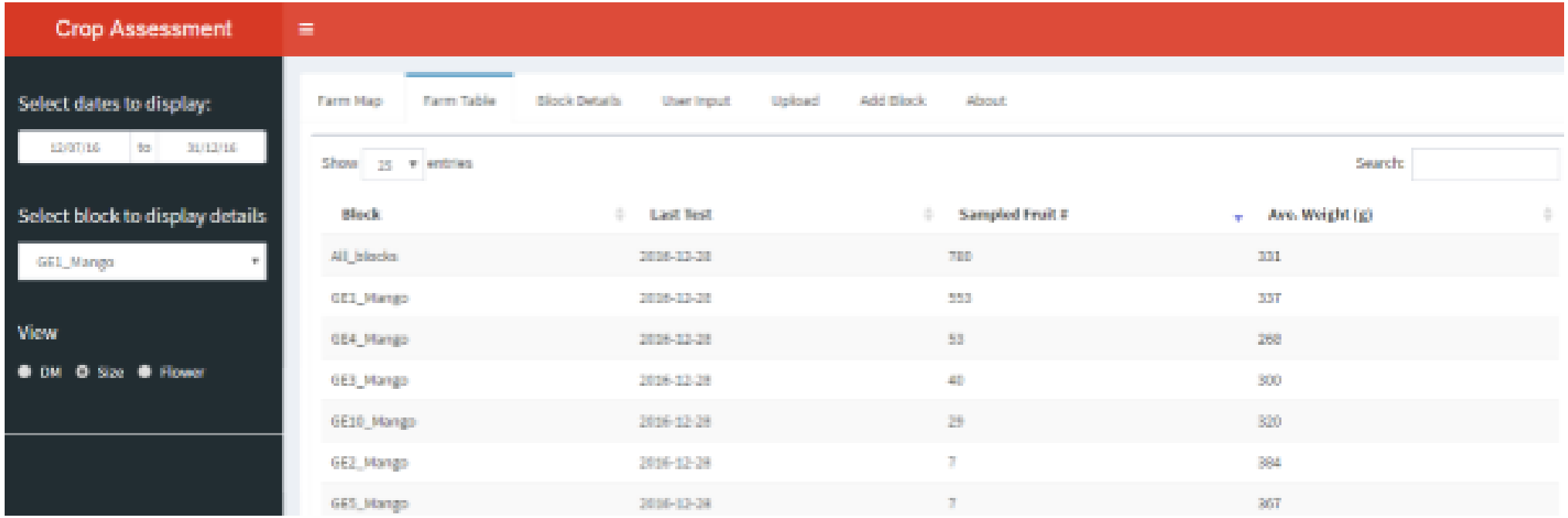
View

DM Size Flower

Farm Map | Farm Table | Block Details | User Input | Upload | Add Block | About

imaged on 2016-10-23


Crop Assessment
Select dates to display:
12/07/16
to
31/12/16
Select block to display details
GE1_Mango
View
DM
Size
Flower
DM target
15
Farm Map
Farm Table
Block Details
User Input
Upload
Add Block
About
Show 15 entries
Search:
Block
Last Test
Sampled Fruit #
Ave. DM% (31/12/2016)
% Fruit < 15
Target Pick
GE1_Mango 2016-12-14 848 14.5 68.4 2017-01-22
GE2_Mango 2016-12-12 60 13.7 93.3 2017-01-25
GE3_Mango 2016-12-12 27 14.3 81.5 2017-01-17
GE4_Mango 2016-12-12 60 14.1 88.3 2017-01-18
GE5_Mango 2016-12-09 1 17.8 0.0 2016-12-04
GE6_Mango 2016-12-12 61 13.9 86.9 2017-01-25
GE7_Mango 2016-12-09 1 19.0 0.0 2016-11-22


Crop Assessment
Select dates to display:
12/07/16
to
31/12/16
Select block to display details
GE1_Mango
View
DM
Size
Flower
Farm Map
Farm Table
Block Details
User Input
Upload
Add Block
About
Show 15 entries
Search:
Block
Last Test
Sampled Fruit #
Ave. Weight (g)
All_blocks 2016-12-28 780 331
GE1_Mango 2016-12-28 553 337
GE4_Mango 2016-12-28 53 268
GE3_Mango 2016-12-28 40 300
GE10_Mango 2016-12-28 29 320
GE2_Mango 2016-12-28 7 394
GE5_Mango 2016-12-28 7 307

Crop Assessment

Select dates to display:

12/07/18 to 31/12/16

Select block to display details

GE1_Mango

View

DM Size Flower

Farm Map | Farm Table | Block Details | User Input | Upload | Add Block | About

GE1_MANGO

Summary

1
Flower images

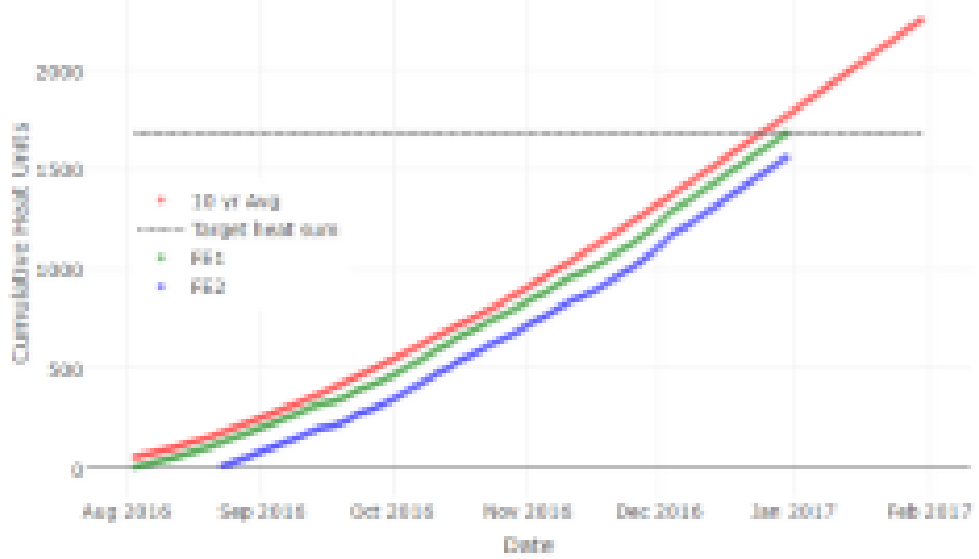
60
% flowering event 1

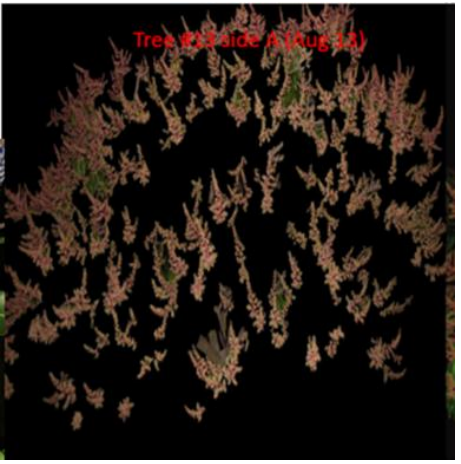
40
% flowering event 2

2017-01-01
projected pick date for flower event 1

2017-01-08
projected pick date for flower event 2

Heat Sum Plot





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