Yield prediction – any closer to getting it right?

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Outline

Block forecasts – what is achievable now

Regional forecasts – a new approach

Technology and block forecasts

Block forecasts

http://research.wineaustralia.com/resource_categories/yield-forecasting

What is getting it right?

What would winemakers like?

± 5%

Industry performance 2000/2001 ± 33% (Clingeleffer 2001)

Forecasting performance

INNOVATORS NETWORK

Why are grower forecasts so inaccurate?

Growers have a good feel for average production over time,

but don’t adjust as much as production actually deviates.

+/- 5% near to harvest is possible

Prior to flowering?

Prior to veraison?

How accurate can we get? (best practice)

bunch counts (spring)	→	± 20%
Berry counts (after set)	→	± 15%
Close to harvest (segments or vines)	→	± 5%

Dunn and Martin (2003)

Accuracy depends on

- Knowledge of block dimensions
- Using the right formula
- Adequate, unbiased sampling
- Prediction of unknowns

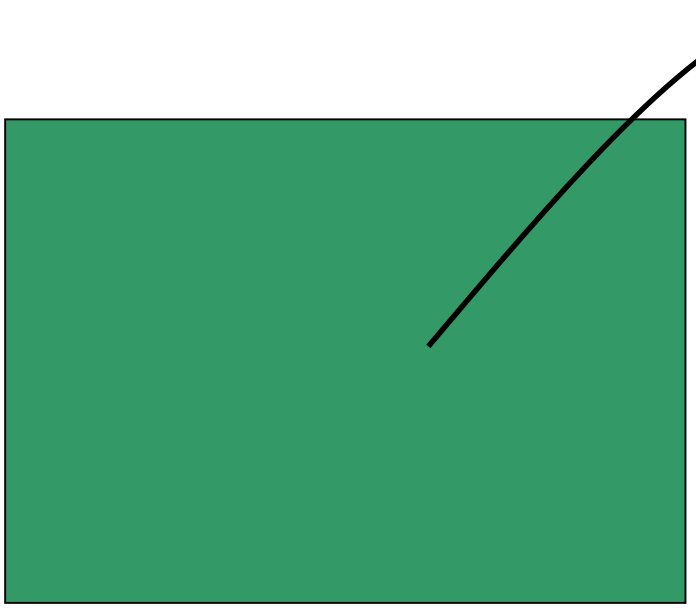
http://research.wineaustralia.com/resource_categories/yield-forecasting/

Impediments to widespread uptake

- Accuracy?
- Field work is time consuming and costly
- Understanding adequate, unbiased sampling
- (fatigue in the field)

Why are block forecasts so inaccurate?

Rely on sampling to estimate and then making predictions



Sample approx. 30 segments (estimate bunch number)

Predict bunch size at harvest

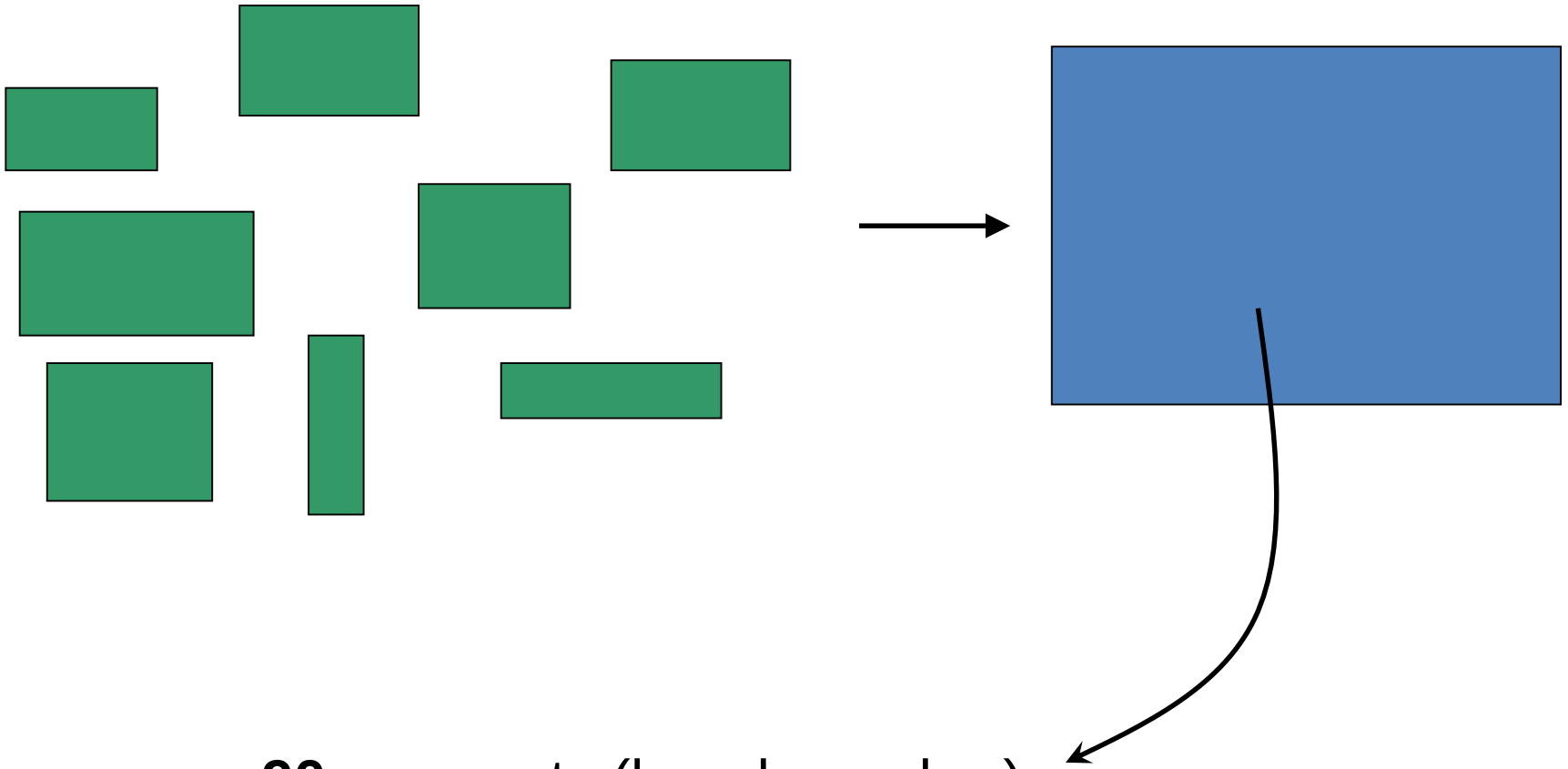
What doesn’t work

- Veraison bunch weight multipliers
- Trellis tension wire
- Growing Degree Days
- Pollen counts
- Weather-based models?

Regional forecasts

http://research.wineaustralia.com/wp-content/uploads/2014/01/NWG-1101.pdf

Regional forecasts (sampling)



approx. **90** segments (bunch number)

Regional forecasts (predicting bunch weight)

Assume:

1. berry weight is stable and predictable (e.g. 1.0g, 0.9g 1.1g)
2. rachis gains little weight from the after set stage through to harvest (Huglin and Schneider 1998; Ribéreau-Gayon 1998)

Bunch weight estimation – after set

1. Collect 80 bunches randomly (say 8 x 10) and weigh

Weight/80 = BuWt1

2. Rapidly remove berries (not all), randomly select 200 and weigh

Weight/200 = BeWt1

Bunch weight estimation – after set

Assume final berry weight (harvest) = HBeWt

Then calculate bunch weight at harvest (HBuWt):

HBuWt = (BuWt1x 0.85) x (HBeWt /BeWt1) – mechanical harvesting

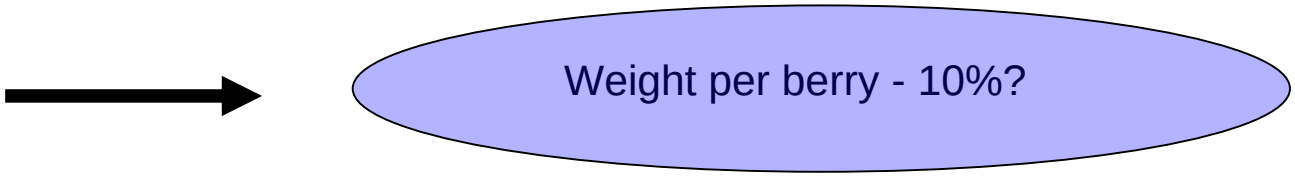
HBuWt = (BuWt1x 0.85) x (HBeWt /BeWt1) + (BuWt1x 0.15) - hand

Time approx 45 mins

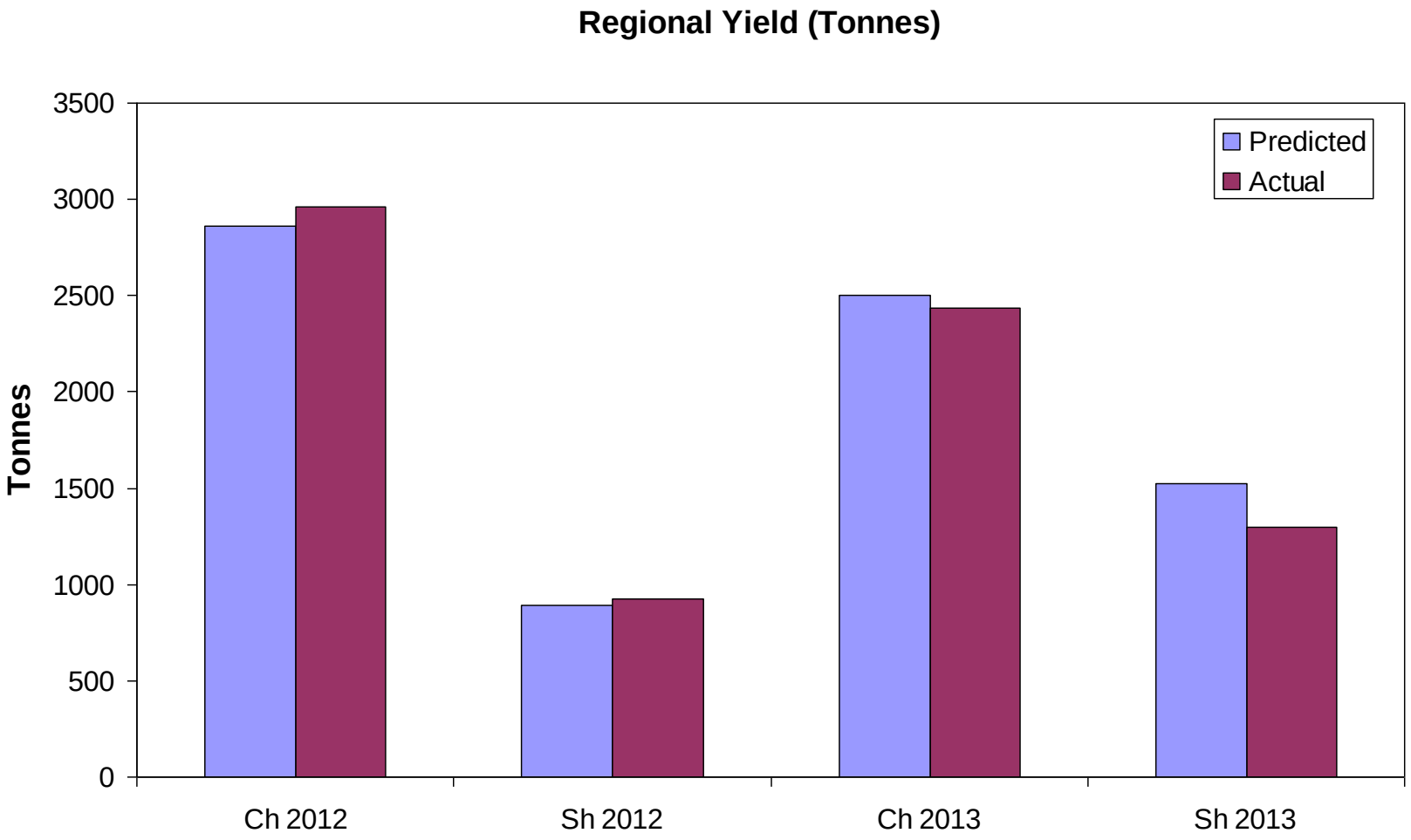
Predicting, which component

Bunches per vine - 60%

Berries per bunch - 30%



+/- 6%


Regional Yield (Tonnes)
Tonnes
3500
3000
2500
2000
1500
1000
500
0
Predicted
Actual
Ch 2012
Sh 2012
Ch 2013
Sh 2013

Why are regional forecast more accurate?

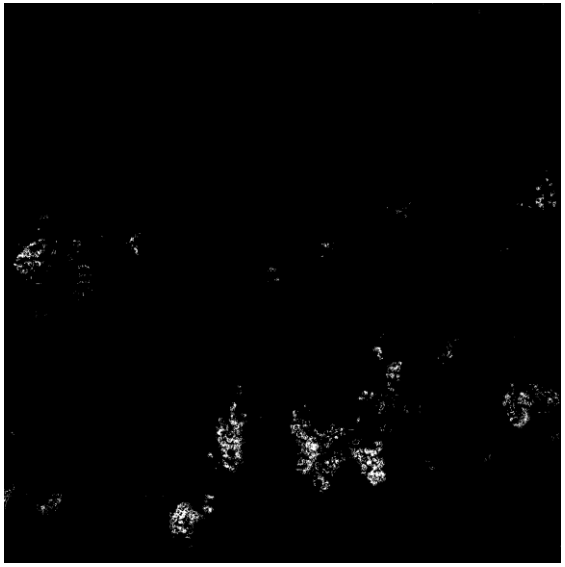
Better prediction of bunch weight (using berry weight)

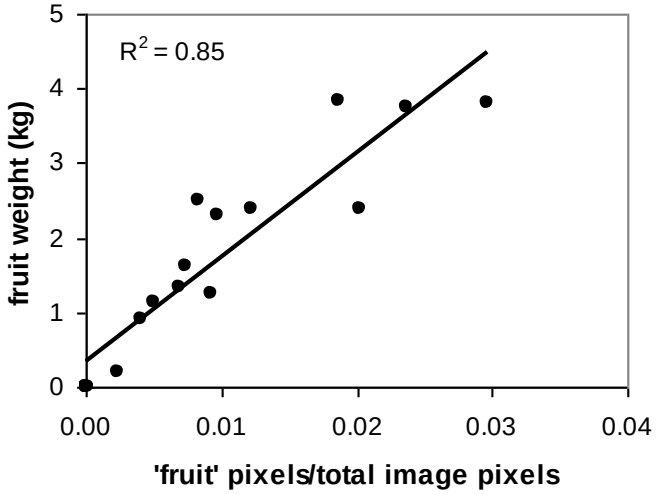
Increased sampling intensity (90 versus 30 segments)

More yield variation within blocks than between blocks

Technology and block level forecasts

Image analysis





(Dunn and Martin 2004)

Sensing and processing (and automation) technology

- Increase sampling
- Reduce costs and labour
- Remove bias

Improved Yield Prediction for the Australian Wine Industry

Funding: Wine Australia
Partners: DPI NSW, UNSW, Treasury Wine Estates
(July 2014 – June 2017)

DPI NSW
- Dr Gregory Dunn

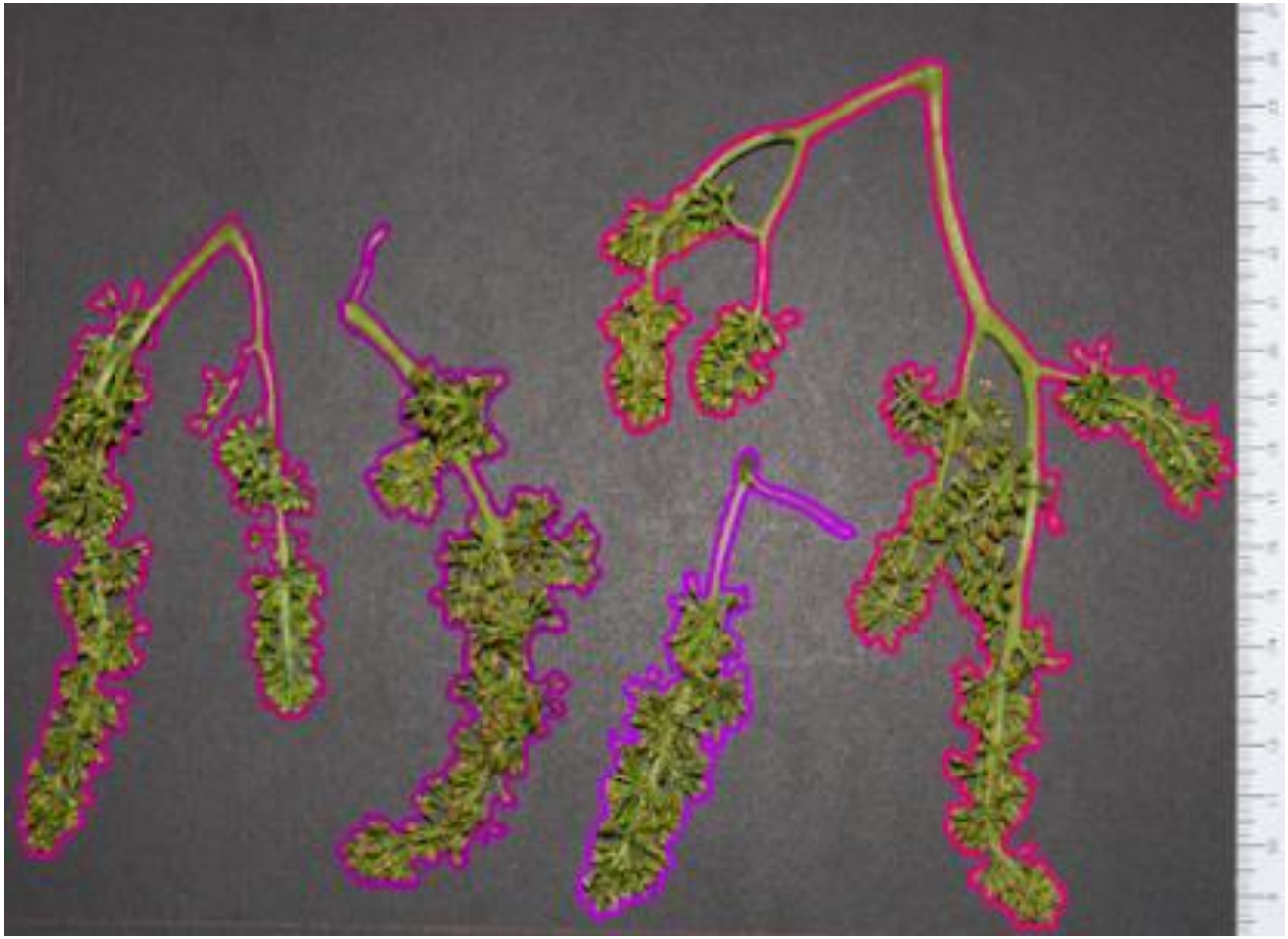
UNSW
- Dr Mark Whitty
- Dr Steve Cossell
- Scarlett Liu

Treasury Wine Estates
- Dr Paul Petrie
- Angus Davidson
- Catherine Wotton

http://research.wineaustralia.com/research-development/current-projects/improved-yield-prediction-for-the-australian-wine-industry/

Inflorescence and fruit sensing

Counting flowers on inflorescences



Berry detection and measurement

Bunch reconstruction from images

Methods

Post set

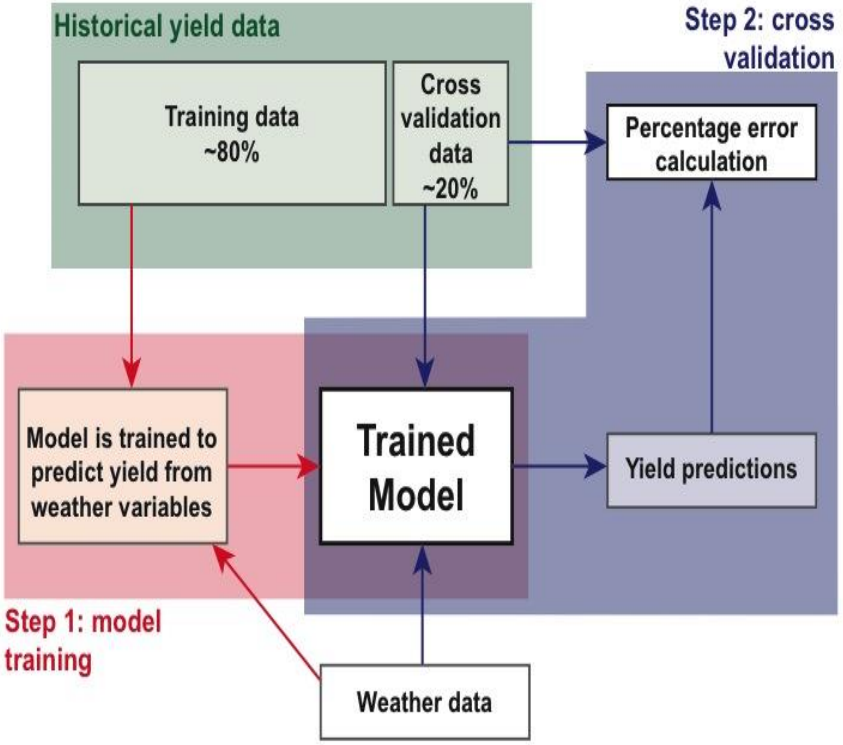
- Visible berries, berry size and berry size prediction (occlusion factors)

- Bunch number imaging, visible bunch imaging and berry size prediction

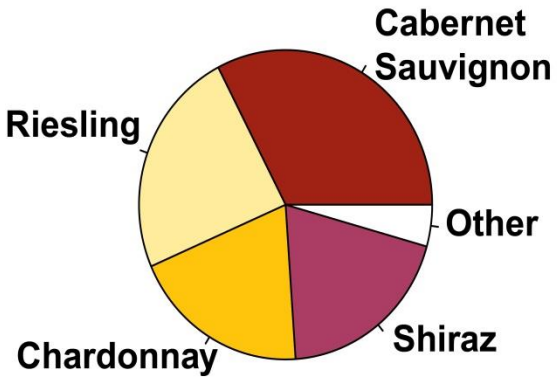
Pre flowering

- Shoot number imaging and flowers per shoot (two step process) – predicting set and berry size

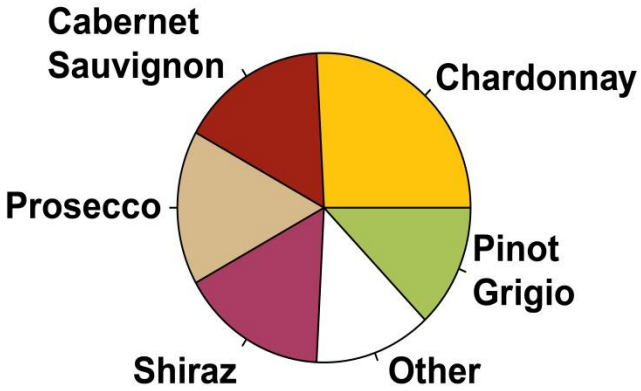
The Weather?
Dr Steve Van Sluyter (Macquarie University)



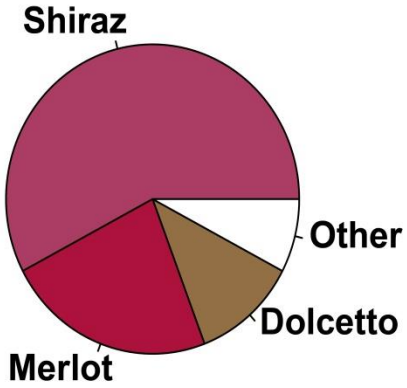
Eden Valley



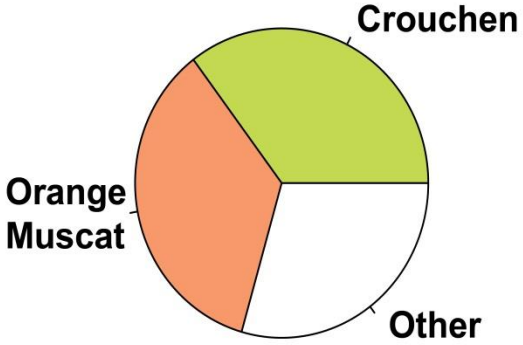
King Valley

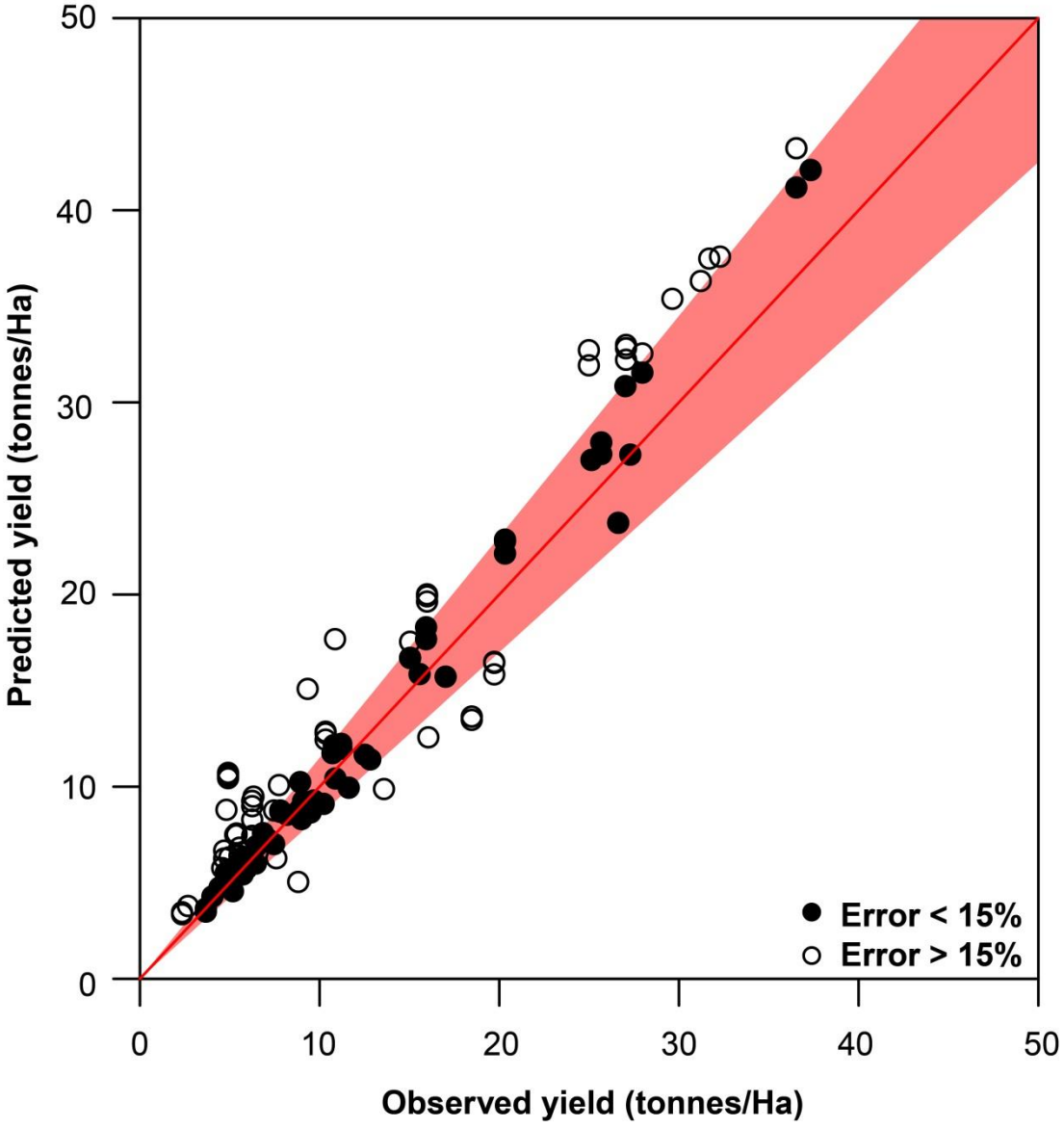


Heathcote



Swan Hill




Predicted yield (tonnes/Ha)
Observed yield (tonnes/Ha)
0
10
20
30
40
50
Error < 15%
Error > 15%

NATIONAL Wine & Grape INDUSTRY CENTRE

Yield prediction – any closer to getting it right?

Acknowledgements

- Wine Australia
- DPI Victoria
- CSIRO
- DPI NSW
- University of New South Wales
- Treasury Wine Estates