

# Financial risk for mixed farming systems in South-eastern Australia

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FUTURE FARM  
INDUSTRIES CRC

PROFITABLE PERENNIALS™ FOR AUSTRALIAN LANDSCAPES

## EH GRAHAM CENTRE

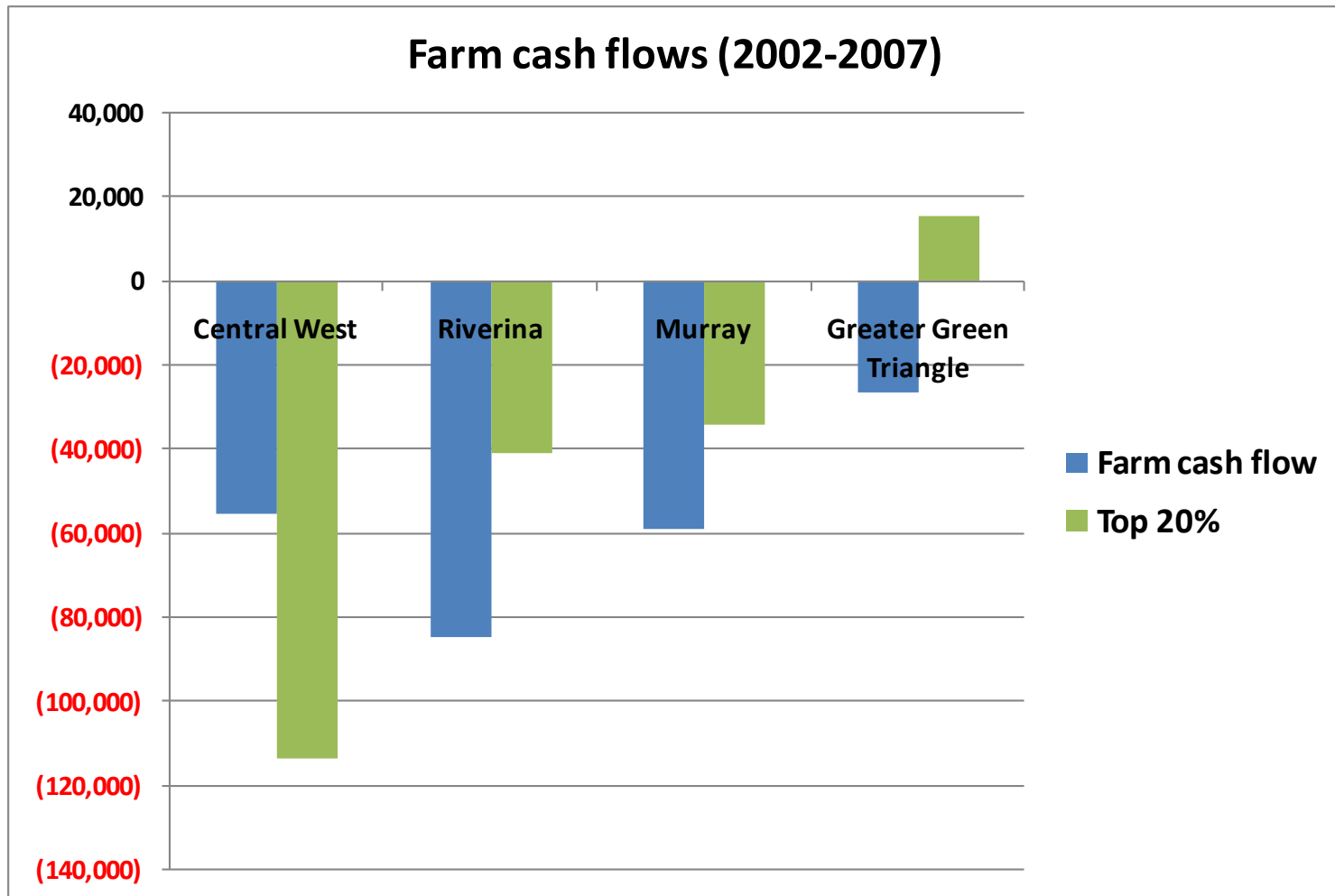
*for Agricultural Innovation*

*An alliance between Charles Sturt University and Industry & Investment NSW*

# A crisis in farming

NAB database, > 750 farms per region

“Top 20%” sorted on profit



# Financial risk in dryland farming

## Why has debt accumulated?

### Hypothesis

**That current “best practice” is flawed, because:**

- a. It is largely based on partial budgeting.
- b. It ignores risk.

**Consequently farmers have adopted unsuitable systems with high risk and low resilience, which have eroded their equity over time.**

# Risk

**Definition: Risk** is the variation in output resulting from uncontrolled variation in inputs.

## Sources of risk

*This study....*

Rainfall

Prices

*Omits.....*

Climatic extremes (fire, flood, frost)

Plagues & pestilence

Regulation

Management

Deaths, disease and divorce

# Central Qld. before Cyclone Yasi



# Process

## **1. Calibration**

2. Optimise stocking rate over each decade

3. Accumulate cash flow (bank account)

4. Model risk using Monte Carlo analysis

# STAGE 1: Calibration

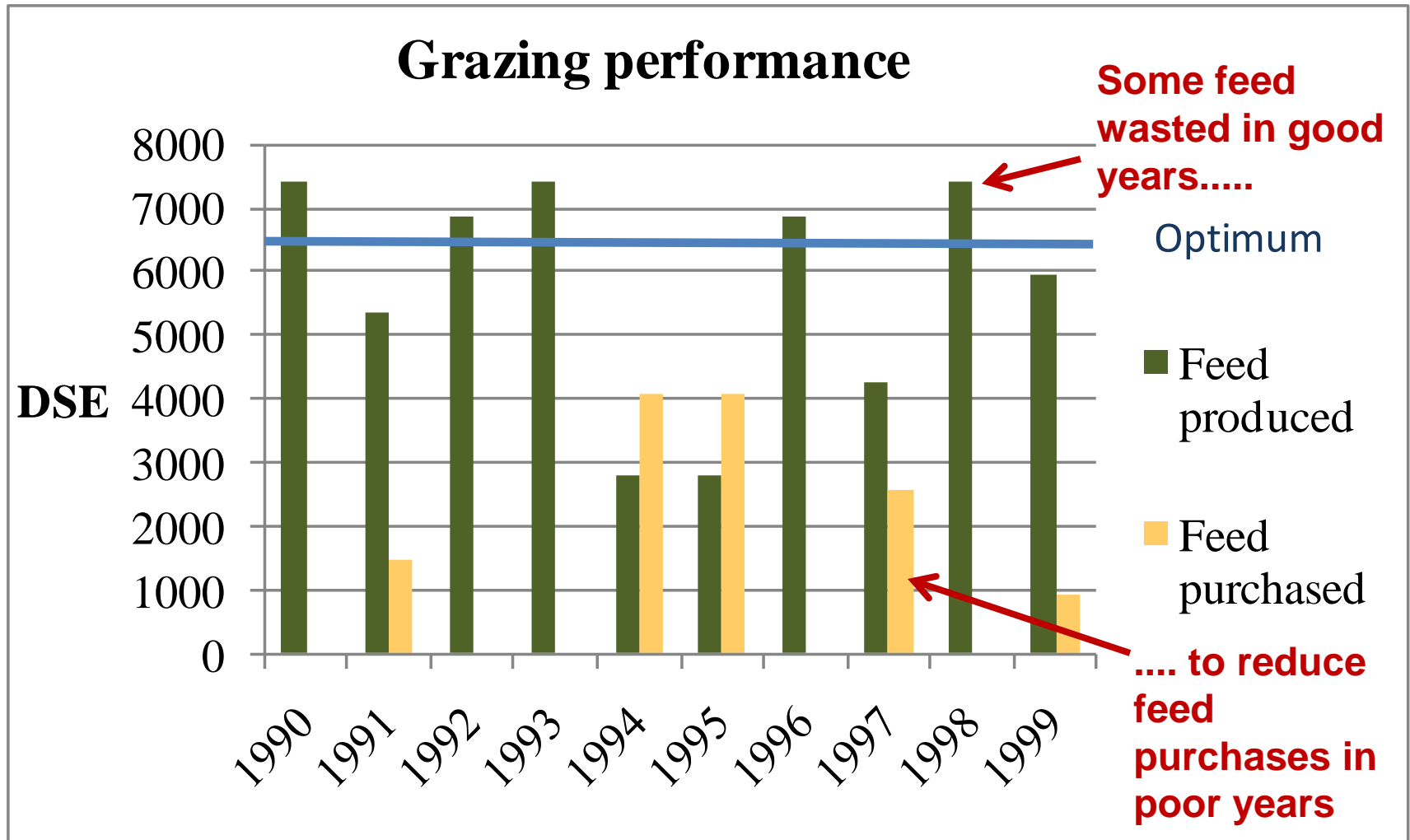
1. **Crop yields** calibrated well with 20-year farm records in regions.  $R^2 > 0.88$
2. **Stocking rate** calibrated closely with Grassgro in each region. Includes grazing crops.  $R^2 > 0.85$
3. **Supplementary feed** requirements also calibrated well with Grassgro.  $R^2$  0.75 to 0.94
4. **Fixed costs** are taken from representative farm records in each region.

## **Step 2: Optimise sheep gross margin**

Using discrete stochastic programming over time

- Optimised over 10 years to maximise ending cash flow (bank balance).
- Controlling variables are supplementary feed and labour costs

# STEP 2: Optimise sheep enterprise



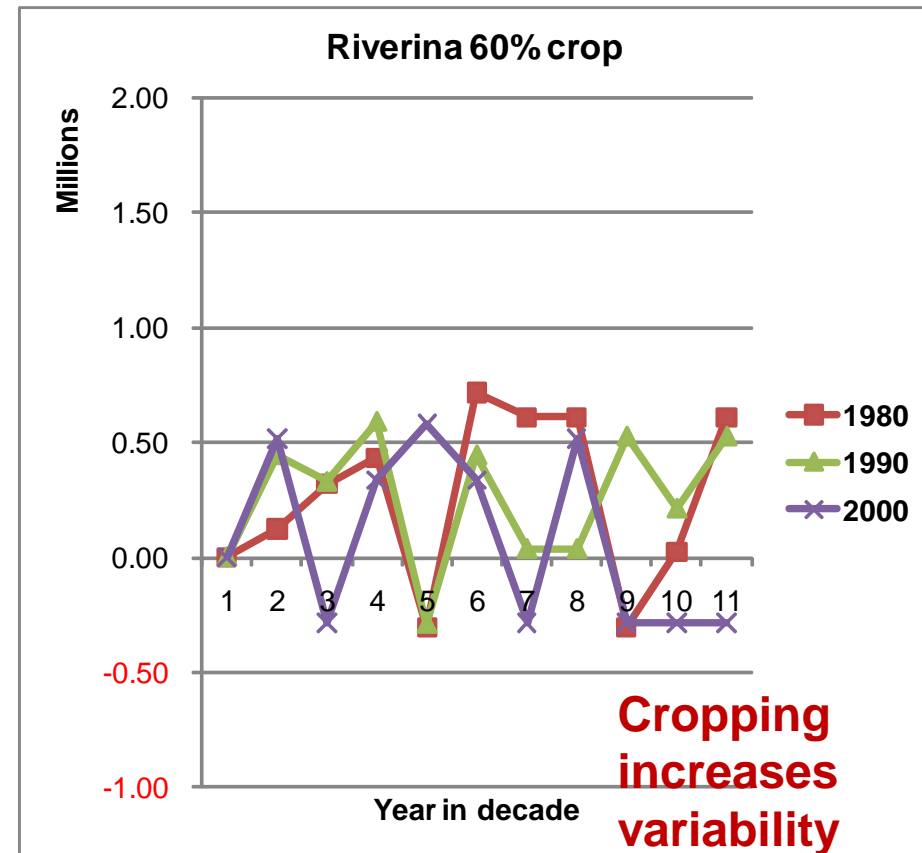
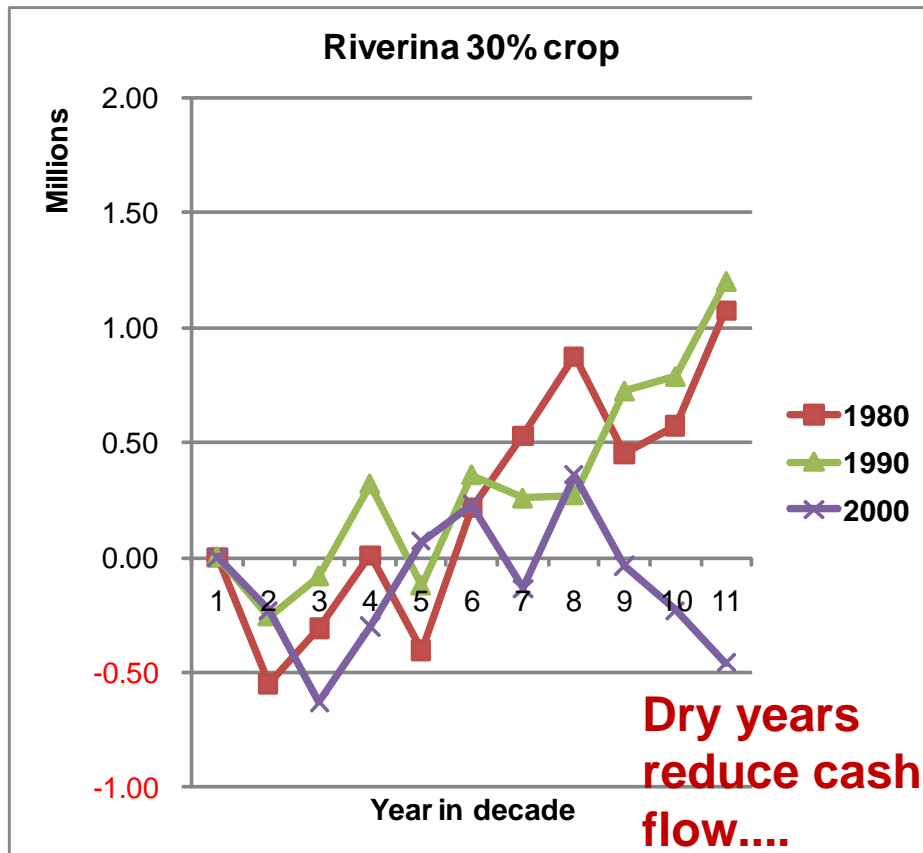
# Process

1. Calibration
2. Optimise stocking rate over each decade
3. **Accumulate cash flow (bank account)**
4. Model risk using Monte Carlo analysis

# STEP 3: Decadal cash flows

Most recent decades

Median values



# Process

1. Calibration
2. Optimise stocking rate over each decade
3. Accumulate cash flow (bank account)
4. **Model risk using Monte Carlo analysis**

# STEP 4 – Monte Carlo analysis

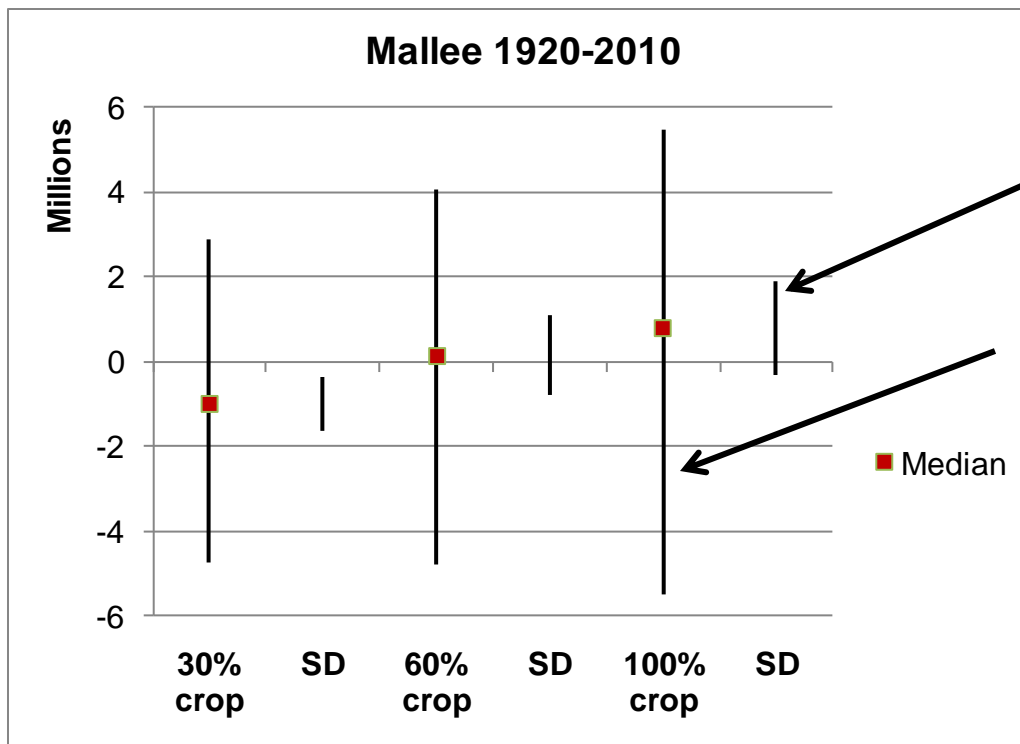
1. Randomises **start year of decade** over past 90 years, ie 80 possible decadal sequences of growing season rainfall.

2. Randomises **price percentiles** for crop, sheep and wool.

*Price percentiles drawn from weekly market data since 2000.*

3. Produces probability distributions from 1000 runs of optimised model for each scenario.

# Range of decadal cash margins (average of 1000 runs)



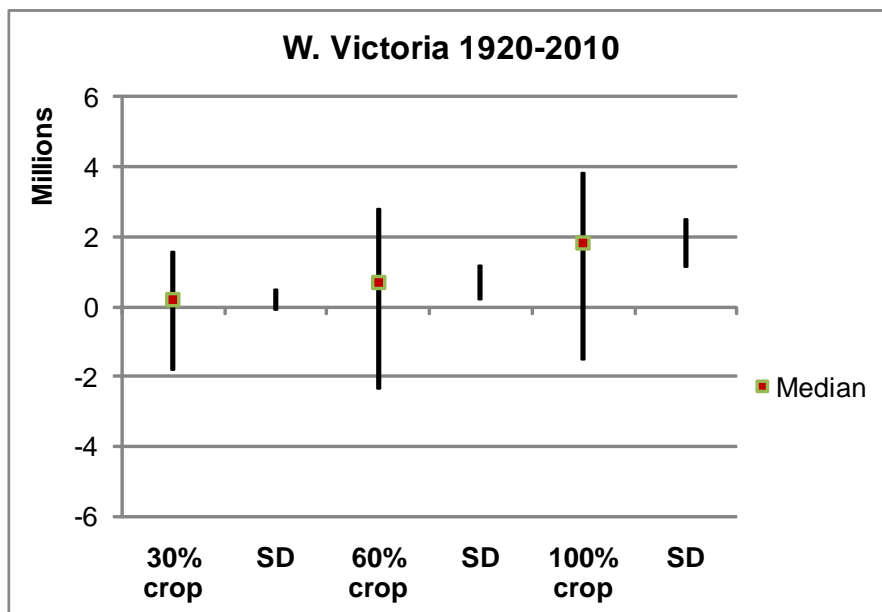
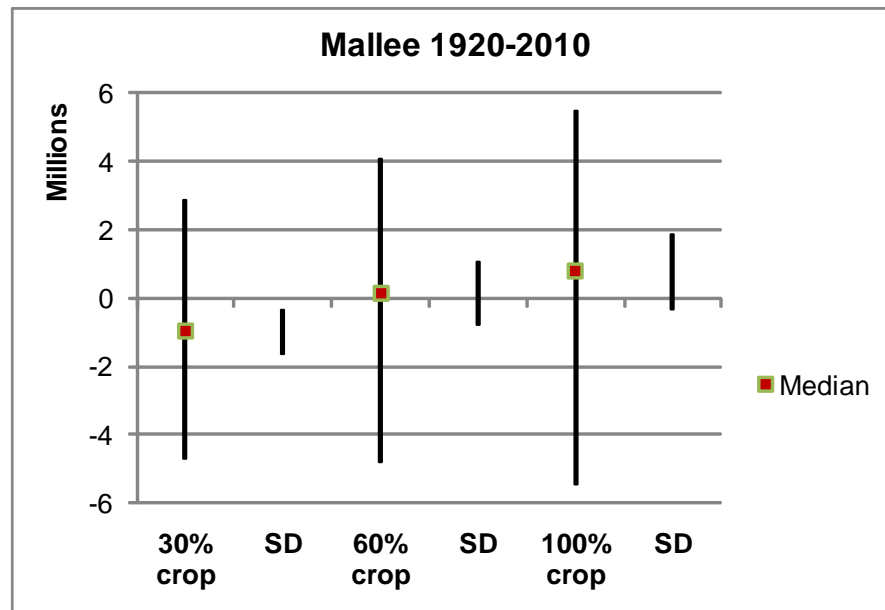
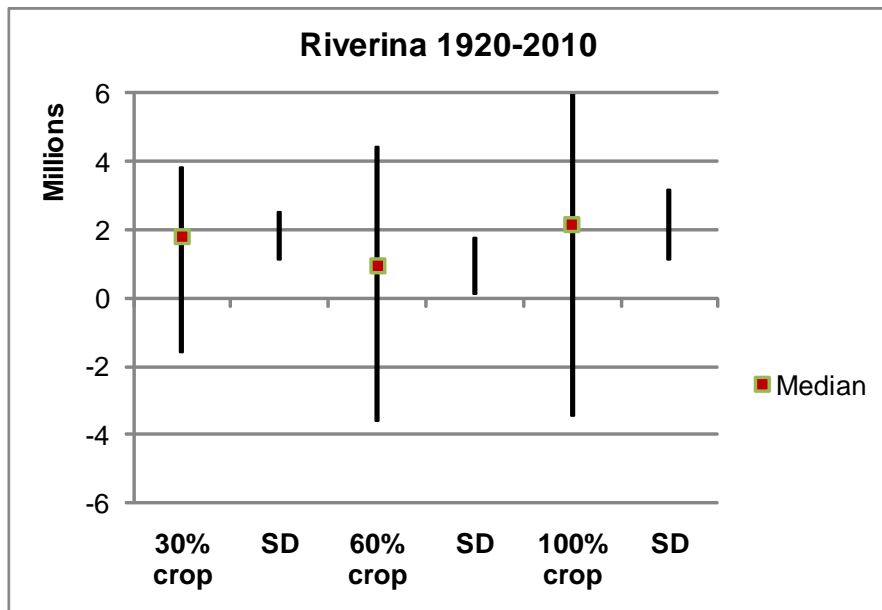
• **Variability** increases with % crop.

• **Skew** (downside risk) increases with % crop.

• **One-off events** further increase downside risk.

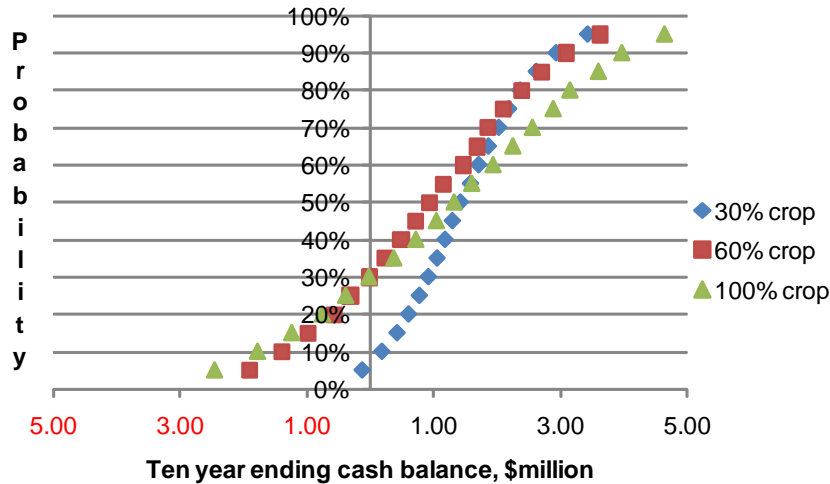
**Q: How representative are single point measurements given the large range?**

# Range of decadal cash margins

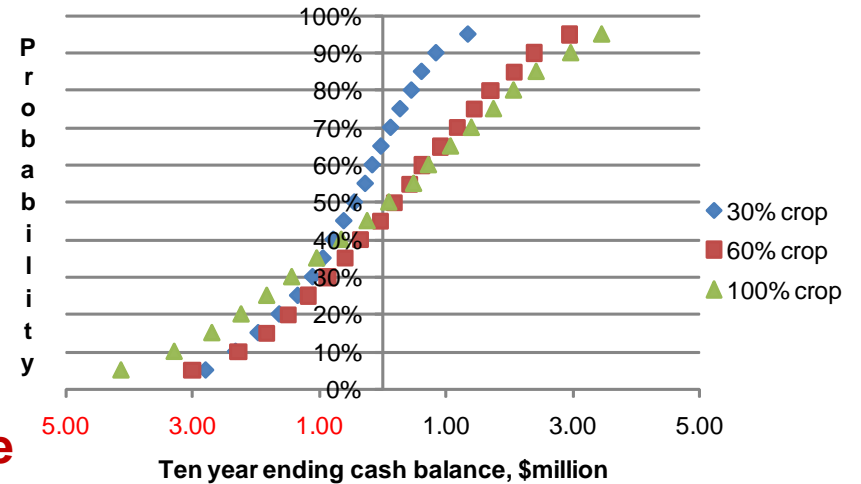


# Risk profiles for all sites and systems

Probability of gain in ten year cash balance  
Riverina 1920-2010

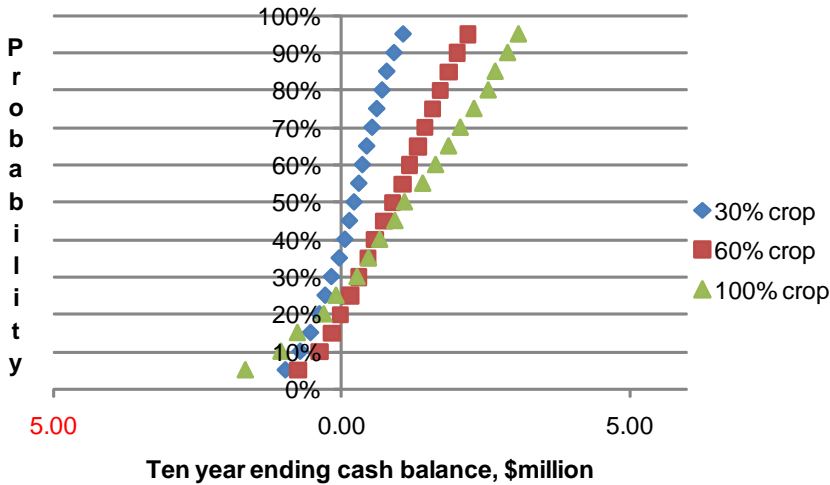


Probability of gain in ten year cash balance  
Mallee 1920-2010

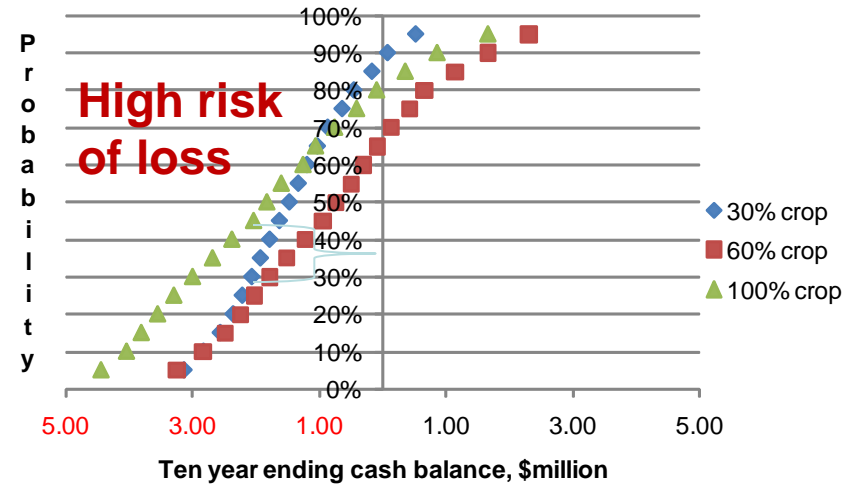


Note  
difference  
between sites

Probability of gain in ten year cash balance  
W. Victoria 1920-2010

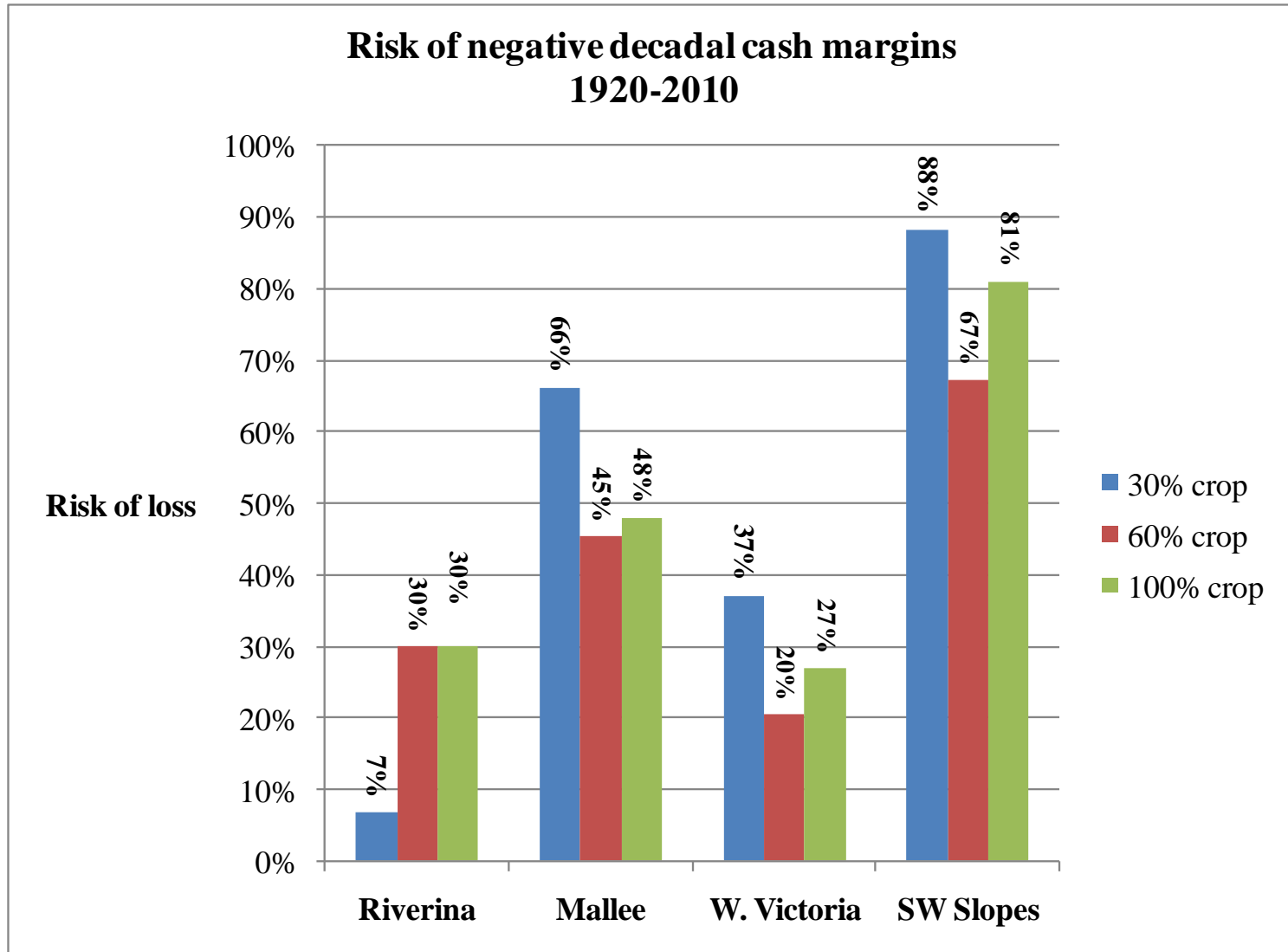


Probability of gain in ten year cash balance  
SW Slopes 1920-2010



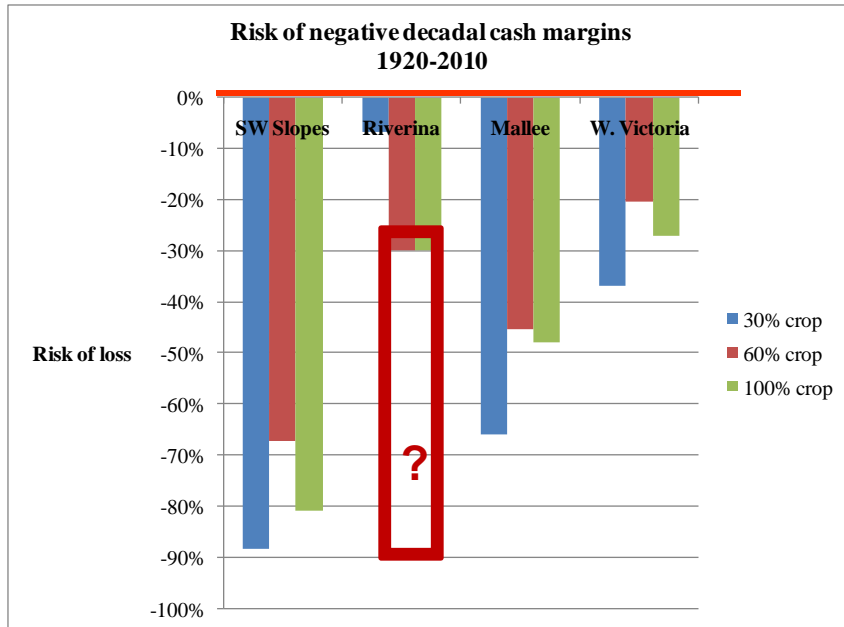
# Risk of loss

Calculated from 1000 runs of model

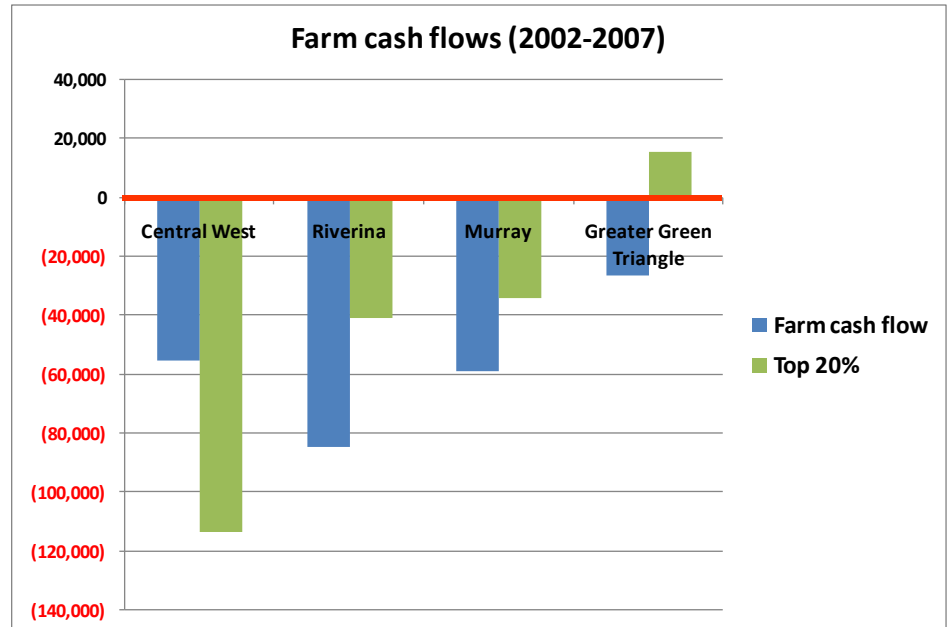


# Importance of losses

## Risk of loss



## Average regional cash flows



**Does this support the opening hypothesis?**

# **Effect of risk on financial indices**

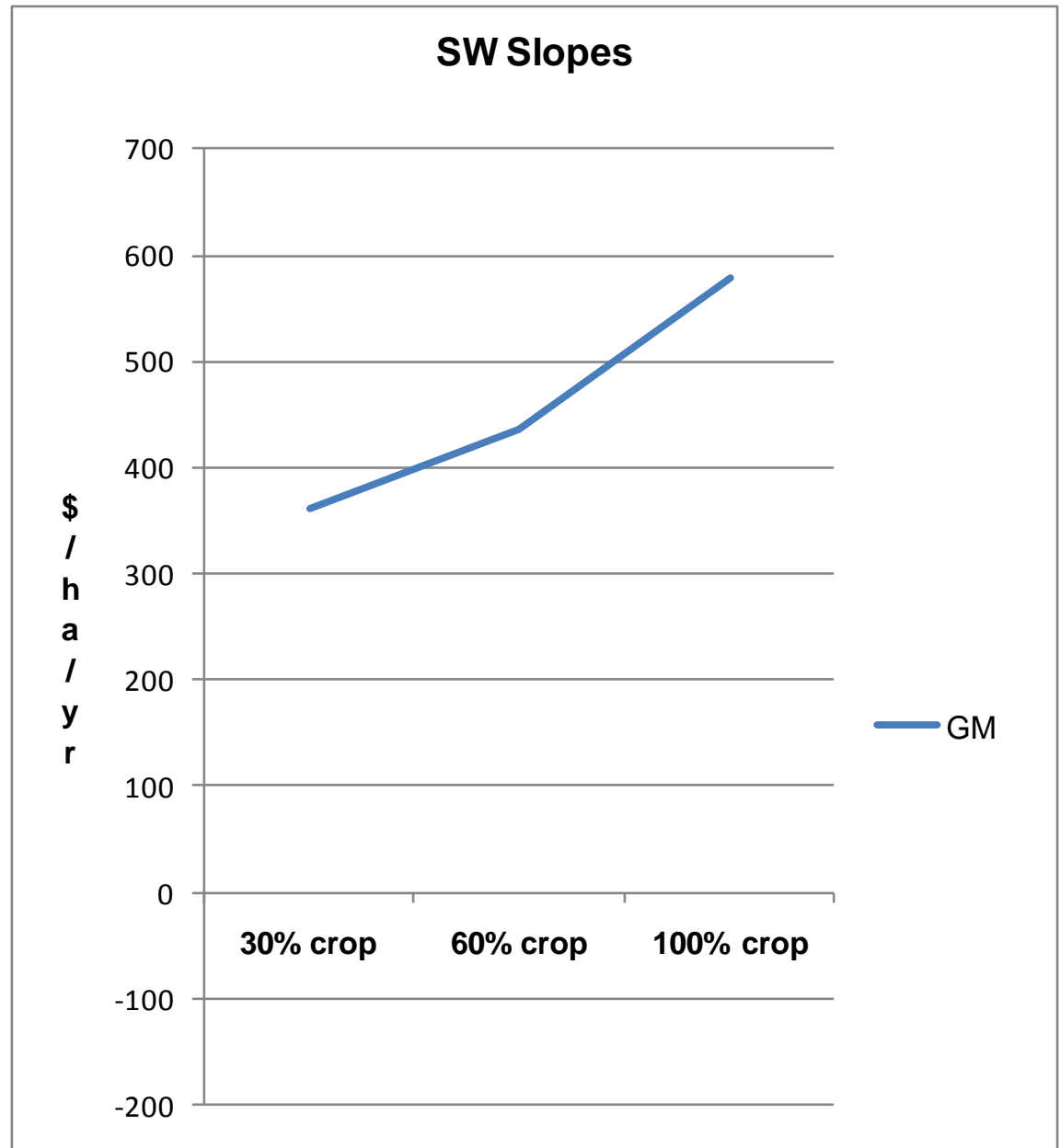
**Normal static KPIs (average years and prices) may be misleading**

# Static KPIs

**Gross  
margin**

30% costs

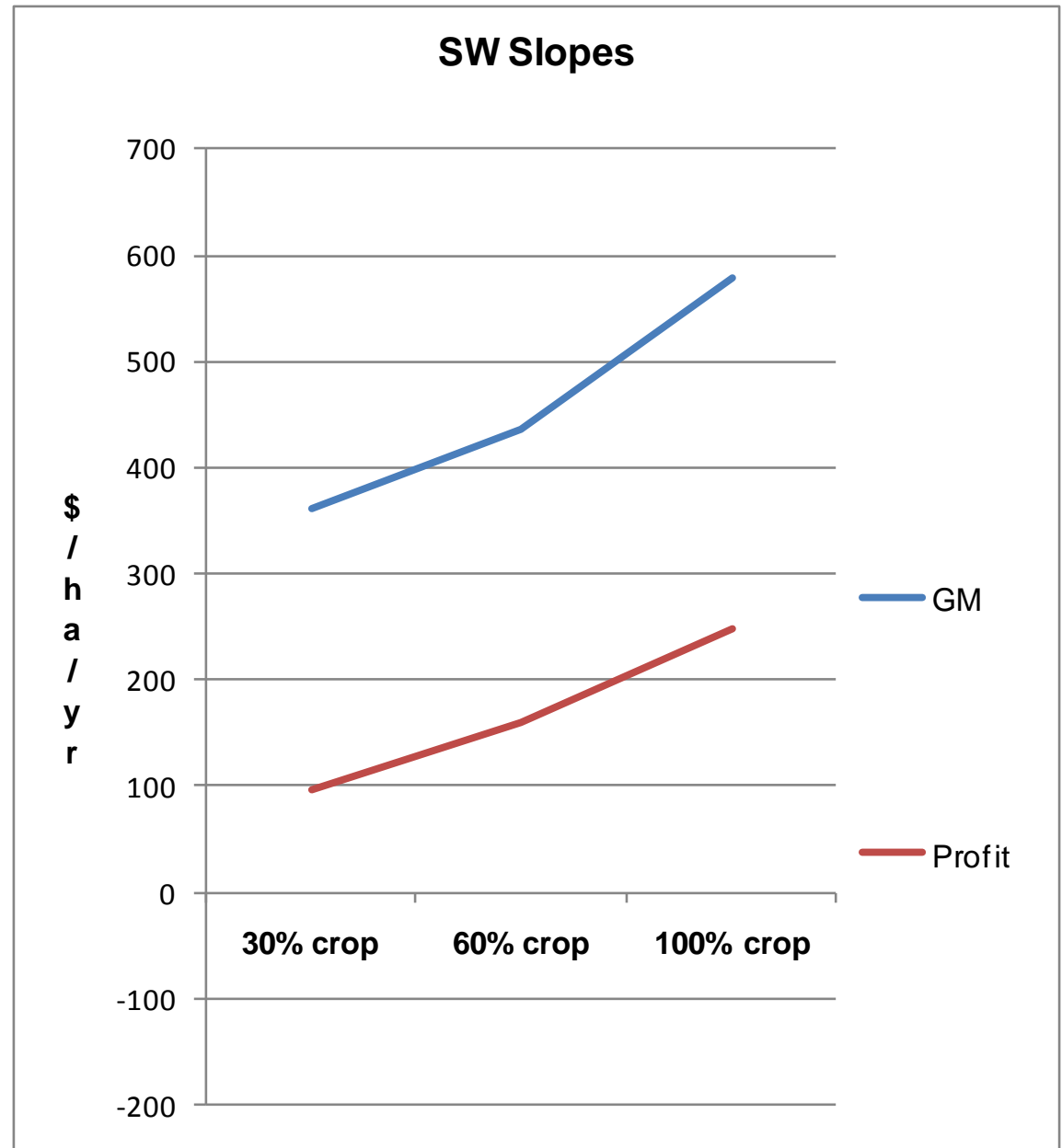
Based on  
average years,  
average prices



# Static KPIs

**Profit**

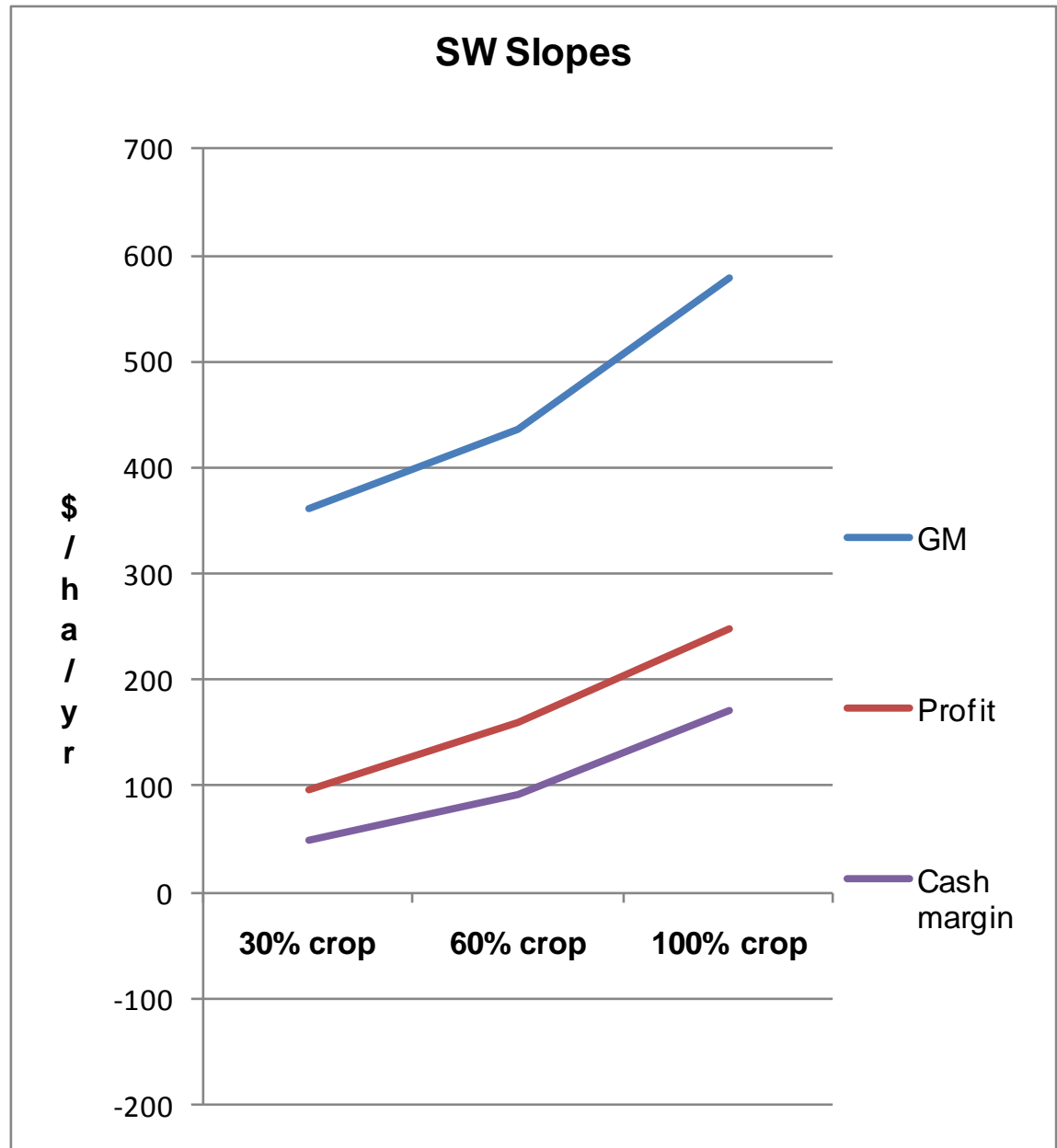
**70%  
costs**



# Static KPIs

Cash  
margin  
(one year)

100%  
costs

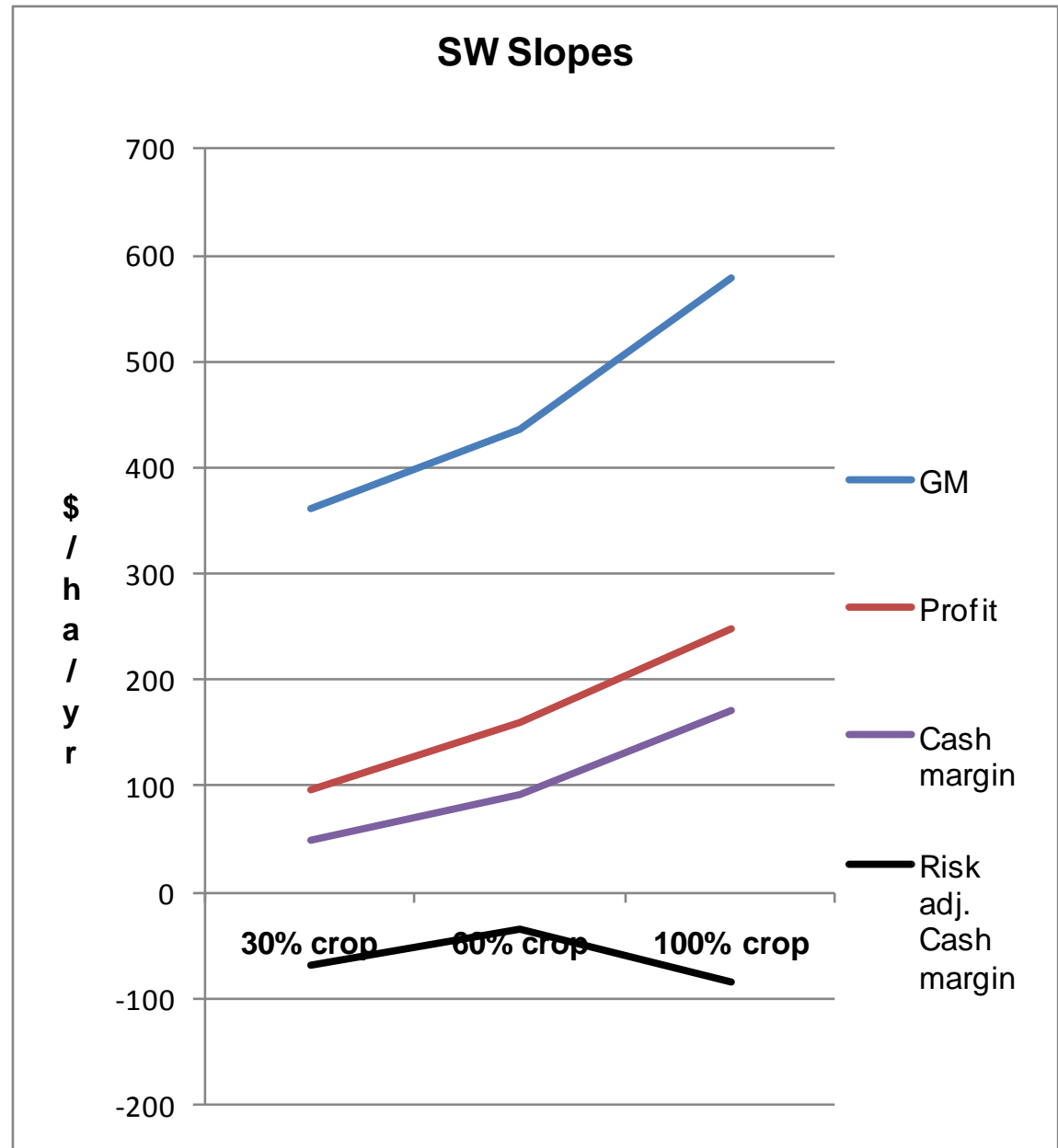


# Dynamic KPI

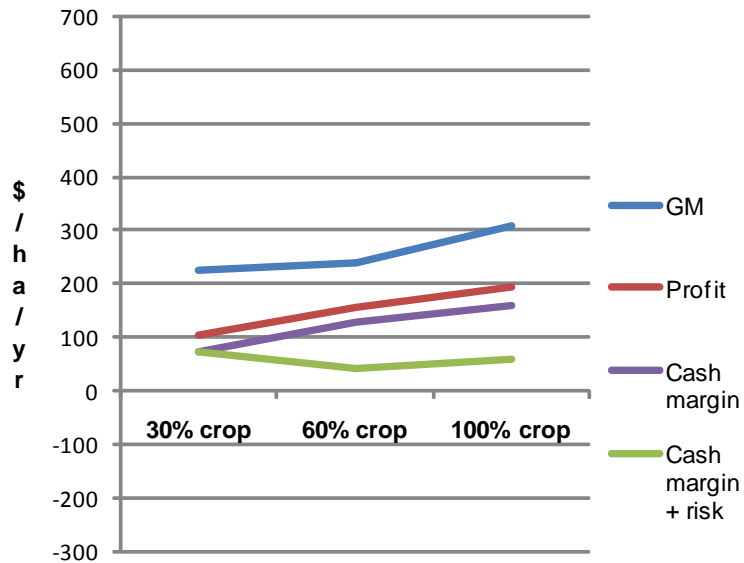
**Risk adj.  
cash  
margin**

(90 years, all  
prices)

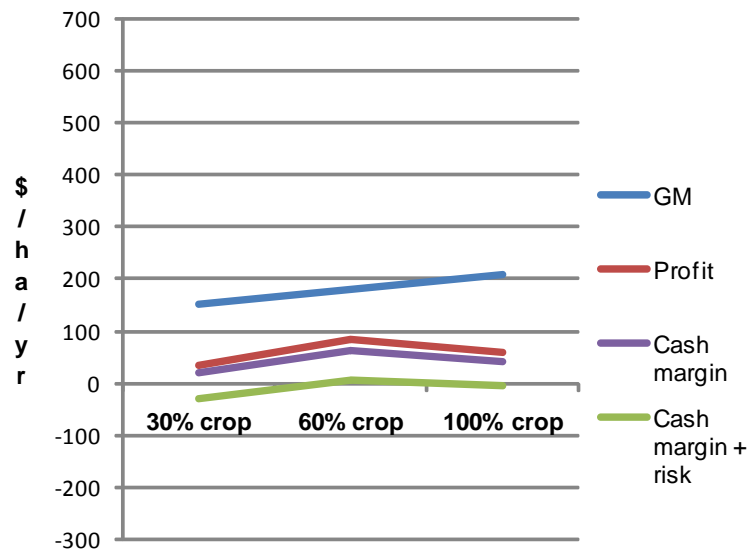
Average of 1000  
runs



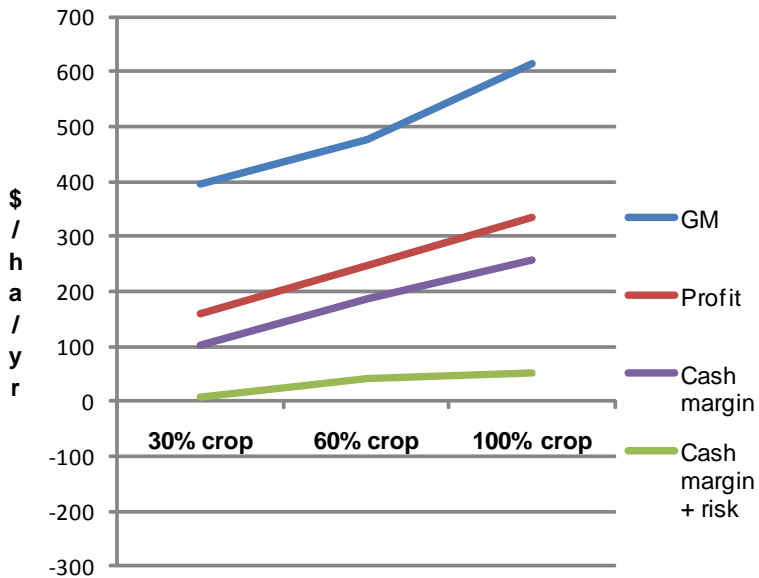
### Riverina



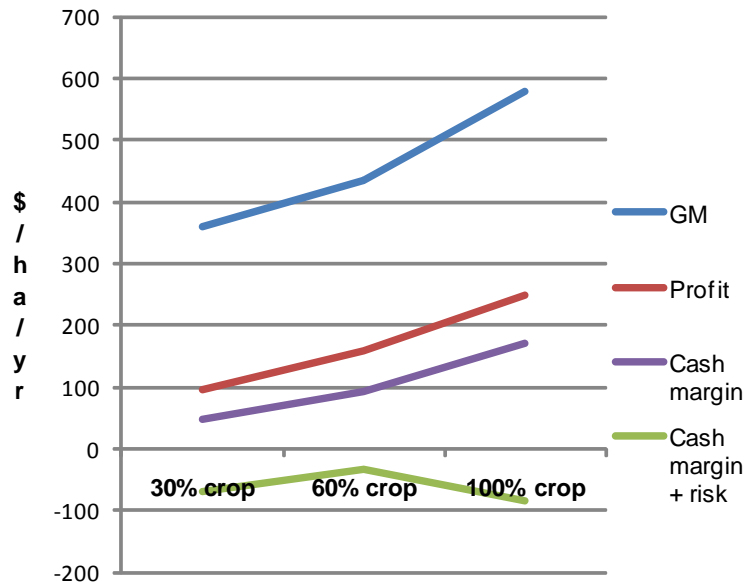
### Mallee



### W. Victoria



### SW Slopes



# Financial risk in dryland farming

## Hypothesis confirmed

**That current “best practice” is flawed, because:**

- a. It is largely based on partial budgeting.
- b. It ignores risk.

**Consequently farmers have adopted unsuitable systems with high risk and low resilience, which have eroded their equity over time.**

# Conclusions

- The **difference** between farming systems is characterised more by their variability than by the average.
- The **range** of possible long-term cash margins dwarfs the scale of likely treatment effects on cash flow.
- **Best practice** varies widely with individual farm business, climate and price.
- **Current best management practice recommendations may result in the adoption of loss-making innovations.**

# Acknowledgements

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**Prof. Kevin Parton** (Charles  
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*Responsibility for any errors  
resides with the authors alone.  
Assumptions, observations,  
results and interpretations in this  
study do not necessarily  
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or any other agency or institution.*



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RESEARCH PARTNERSHIP BETWEEN CSU AND I&I NSW

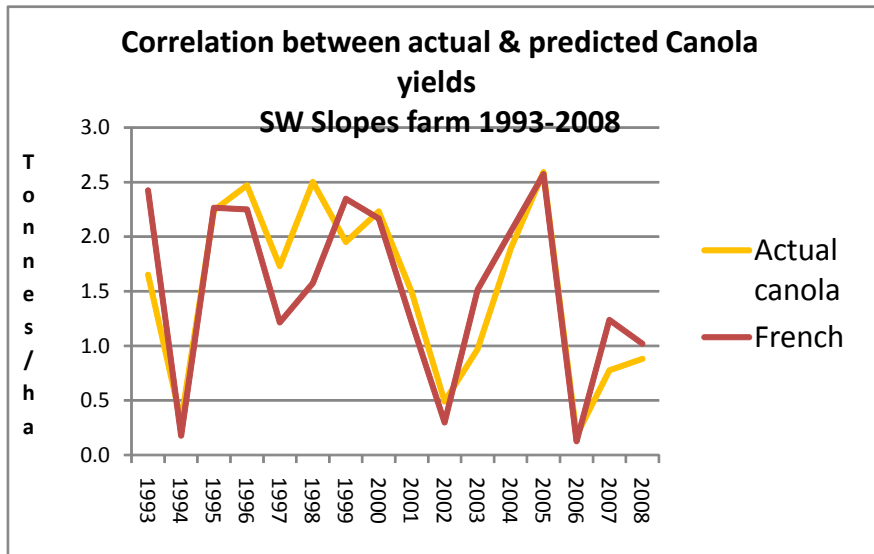
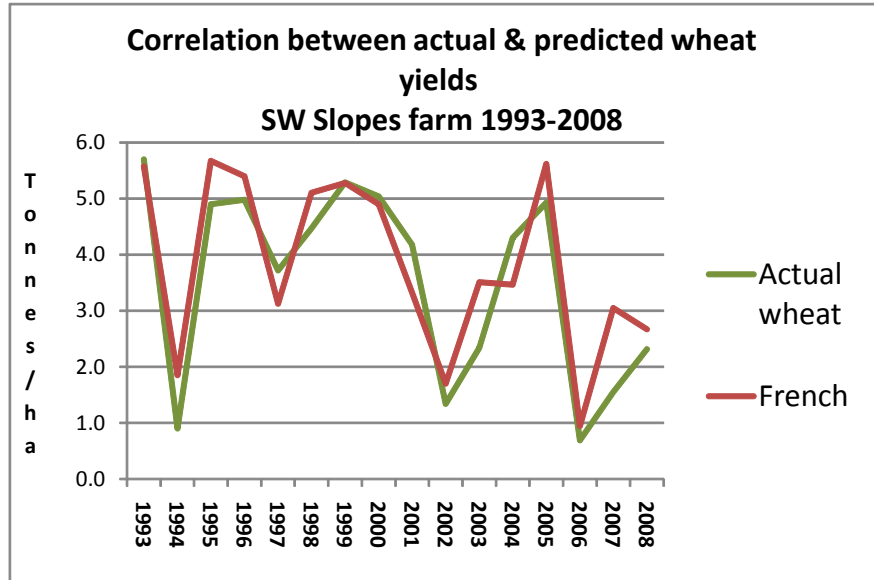


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# STAGE 1

## Crop yield validation with farm results

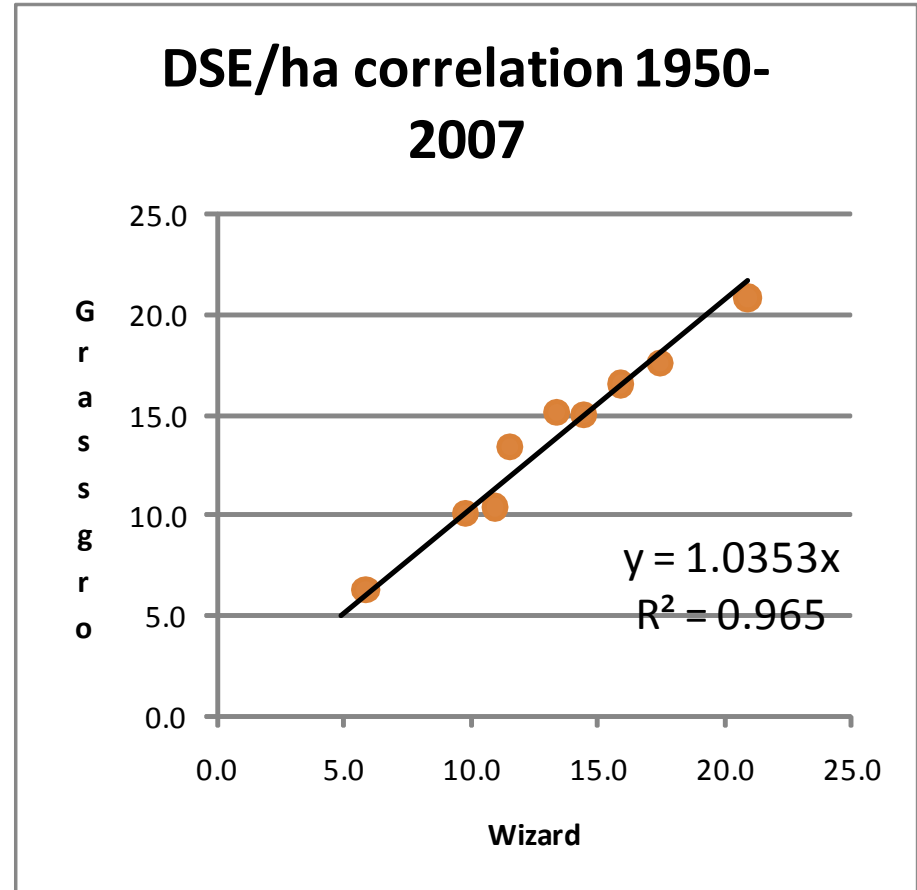


# STAGE 1: Stocking rate calibration

## Overall stocking rates

Decile	Wizard	Grassgro
	DSE/ha	DSE/ha
1	5.9	6.3
2	9.8	10.1
3	11.0	10.4
4	11.6	13.4
5	13.4	15.1
6	14.5	15.0
7	15.9	16.6
8	17.5	17.6
9	20.9	20.8

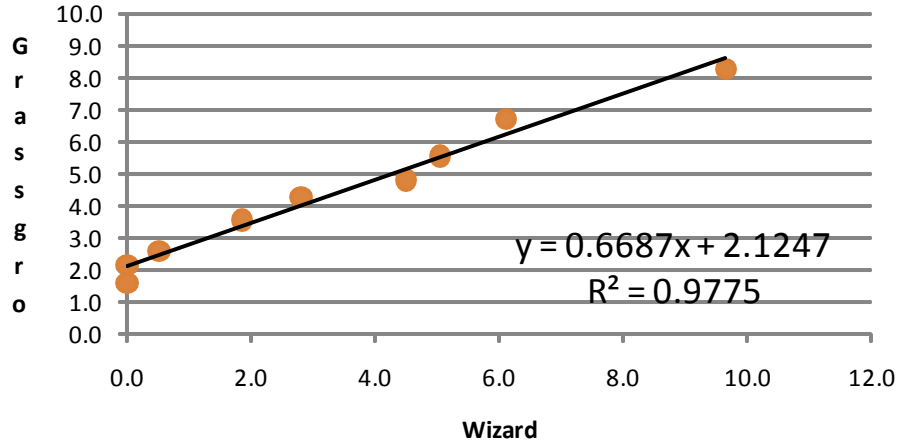
$r^2 = 0.98$



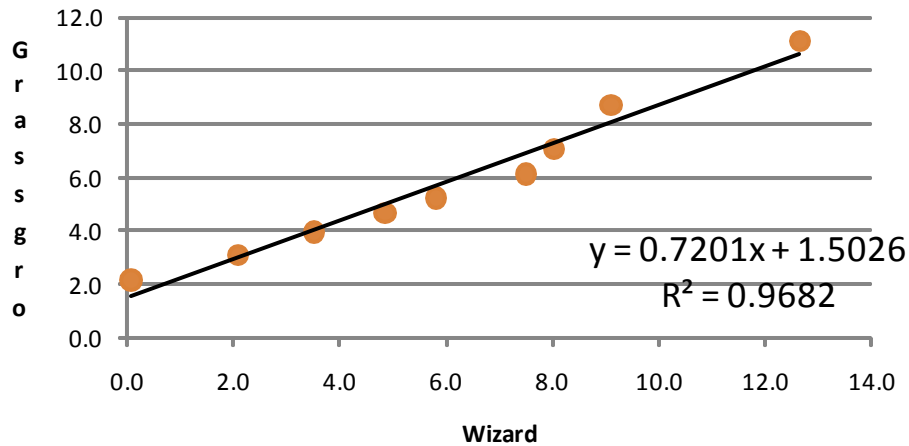
# STAGE 1

## Feed calibration 1950-2007

### 8 DSE feed correlation



### 10 DSE feed correlation



# Process

1. Calibration

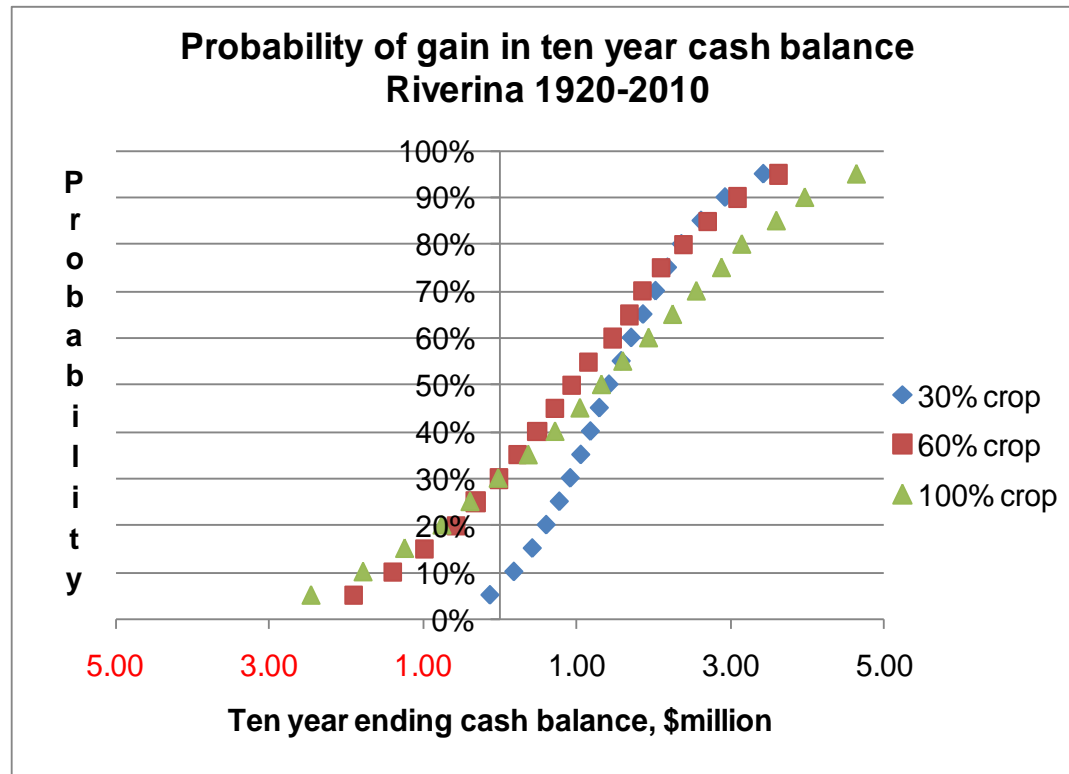
**2. Prepare whole-farm budgets**

# STAGE 2: Site budgets

Median prices and rainfall  
(less livestock gross margin)

	Riverina			Mallee		
	30% crop	60% crop	100% crop	30% crop	60% crop	100% crop
Crop income	425,908	689,282	884,239	176,500	505,085	639,786
Other income	22,394	22,394	22,394	22,394	22,394	22,394
Non-farm	8,962	8,962	8,962	8,962	8,962	8,962
<b>Total</b>	<b>457,263</b>	<b>720,637</b>	<b>915,595</b>	<b>207,855</b>	<b>536,441</b>	<b>671,142</b>
Costs						
Crop	114,570	228,522	282,776	68,100	202,828	285,679
Pasture	87,400	26,600	0	85,750	24,850	0
Machinery	50,000	82,600	82,600	62,000	73,000	84,600
Overheads	58,095	58,095	58,095	64,490	64,490	64,490
Personal costs and super	7,000	7,000	7,000	7,000	7,000	7,000
Capital	52,065	56,750	57,465	58,725	58,725	61,065
<b>Total</b>	<b>373,062</b>	<b>254,214</b>	<b>216,092</b>	<b>346,065</b>	<b>238,977</b>	<b>226,555</b>
<b>Margin</b>	<b>84,200</b>	<b>466,424</b>	<b>699,502</b>	<b>-138,210</b>	<b>297,464</b>	<b>444,587</b>

# Risk profiles for Riverina



1. **Slope** of CDF indicates variability of output  
Caused by effect of **climate** on enterprise mix.
2. **Position on X axis** determined by **cost of production**.  
70 % of costs fixed and capital, only 30% variable

# Effect of risk on financial analysis

**Normal static KPIs (based on averages) may be misleading because:**

- Distribution of outputs skewed, so KPIs may not measure optimum.
- Do not allow for cumulative effects of losses.
- Do not measure variability (time).
- Do not indicate resilience.