

# 2016 GRDC Grains Research Update, Perth



## **Economic analysis of the impacts and management of subsoil constraints**

Dr Elizabeth Petersen

# Aim of the analysis:

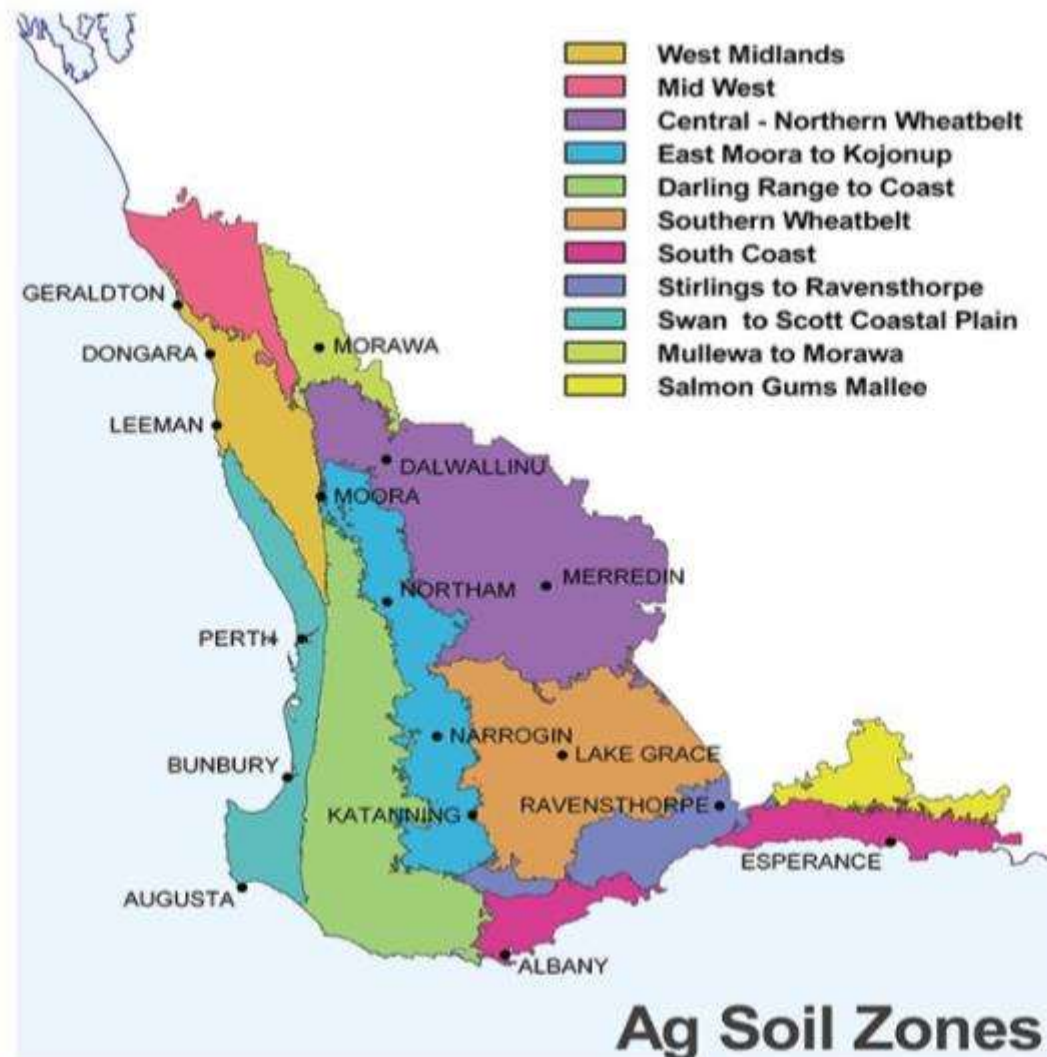
- Economic analysis of the **effects of subsoil constraints on yields, cost structures and profits**
- To analyse the **cost-effectiveness of interventions** for management of subsoil constraints

# Four subsoil constraints:

1. Acidity
2. Compaction
3. Sodicity
4. Transient salinity

- Boron toxicity was considered but not included due to lack of data

# The nine AgZones:



# Methodology:

1. **Estimation of yield loss** due to each constraint, multiplied price and area affected
2. **Discounted cashflow analysis** for each management option

# Area of moderate to high impact ('000 ha)

Acidity	Compaction	Sodicity	Transient salinity
11,430	12,320	5,850	400

Note: Total croppable area of the wheatbelt = 16.4 million ha

# Estimated indicative average value of lost production (\$/ha)

Acidity	Compaction	Sodicity	Transient salinity
141	54	52	19

# Estimated indicative total value of lost production (\$million/year)

Acidity	Compaction	Sodicity	Transient salinity
1,574	883	577	92

Note: As most soils have multiple constraints, these numbers shouldn't be summed

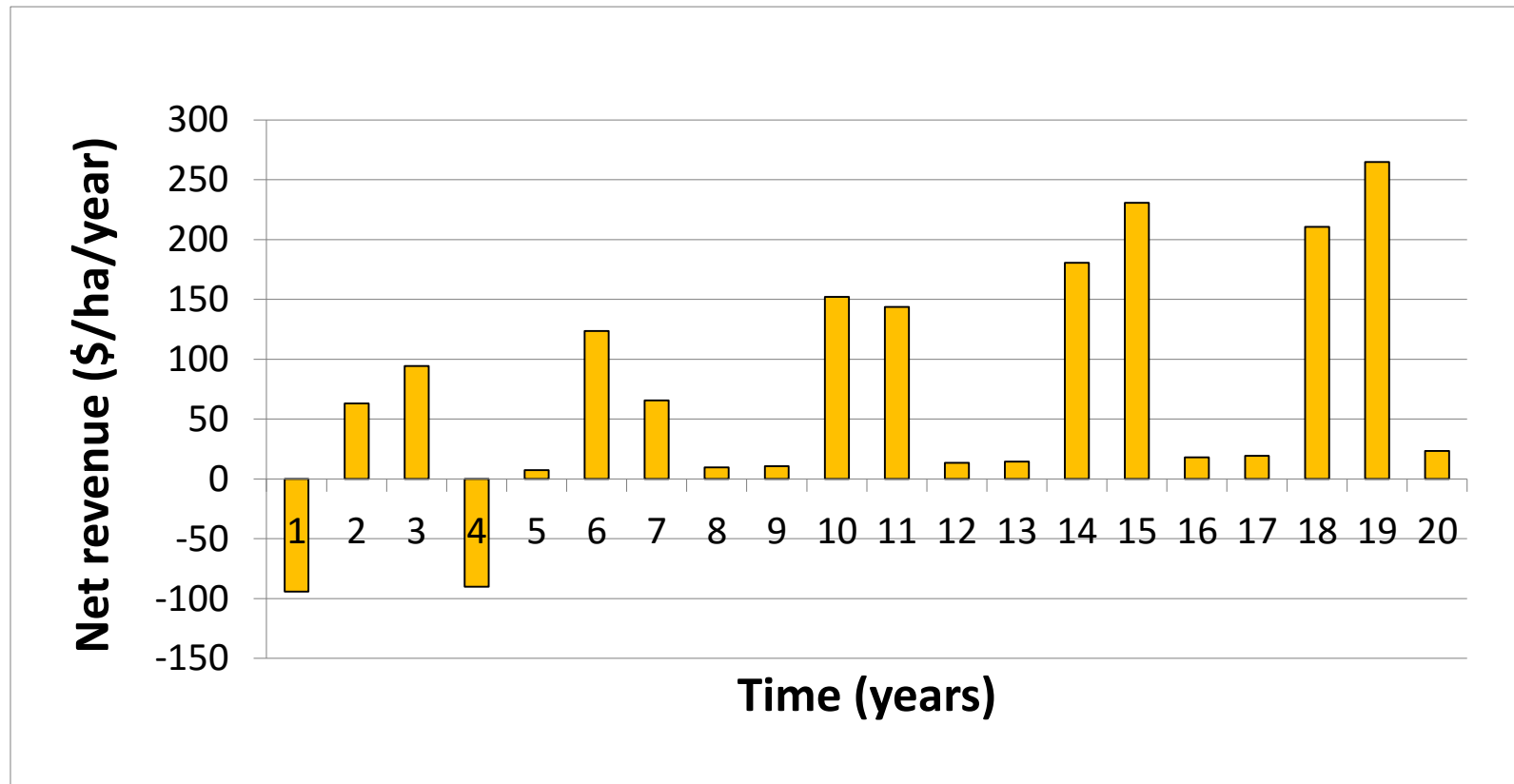


# Managing acidity with lime

- Used **Optlime**
- Considered soil types that make up **70% of area affected**
- **For each region**, considered
  1. Cost of cheapest lime source
  2. Freight distance
  3. Potential yield
  4. Optimal lime application for ameliorating subsoil acidity
- 68 runs

# Example change in net revenue due to liming

Top-dressed and deep-banded in years 1 and 4



# Results for managing acidity with lime

Indicative equivalent annual profit (\$/ha/year over 20 years)	Indicative benefit cost ratio (over 20 years)
63	11:1

# Managing compaction

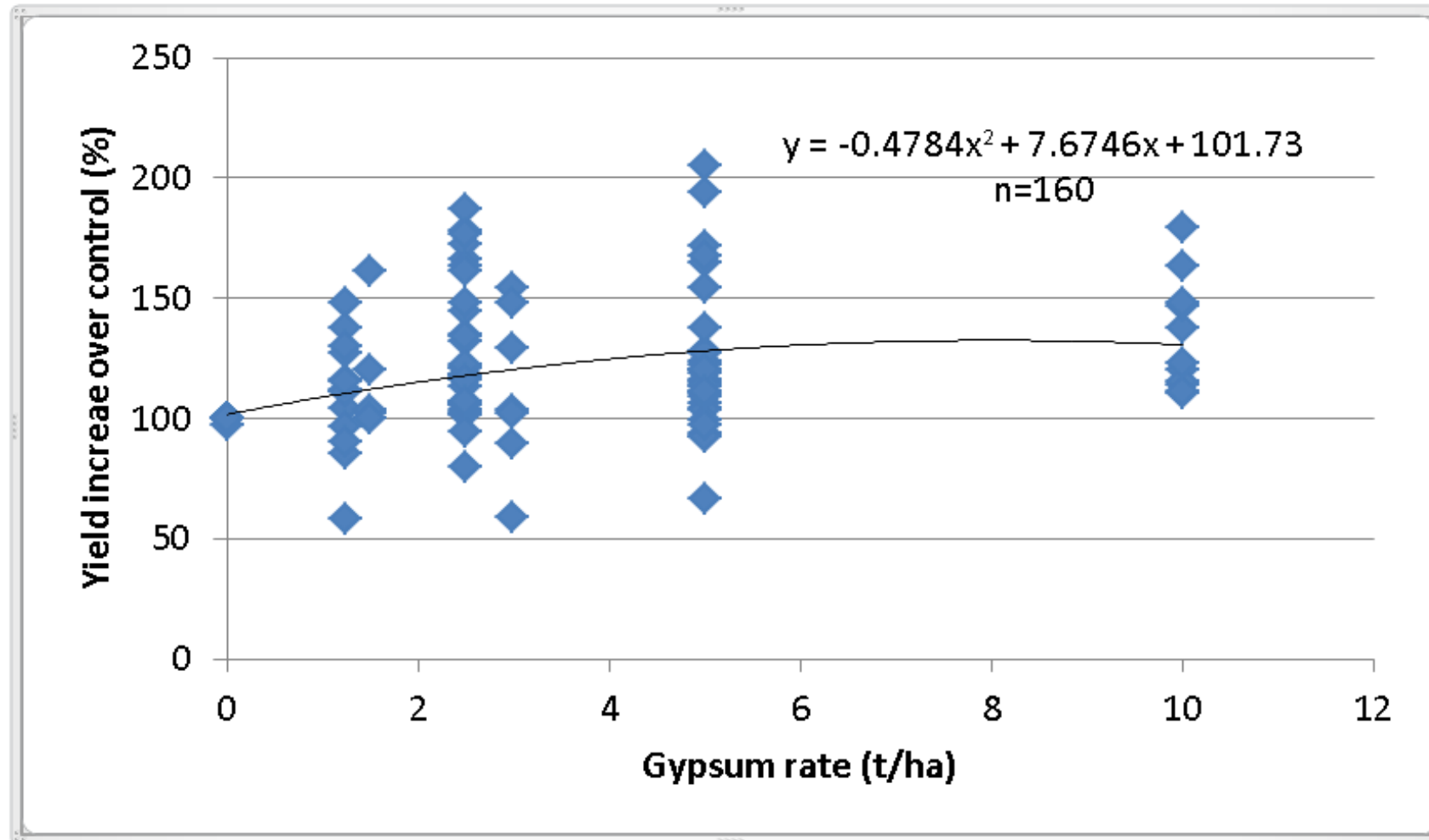
1. **Deep ripping and deep working** (mechanical amelioration)
2. **Deep ripping and deep working with gypsum** (mechanical and non-mechanical amelioration)
3. **Deep ripping and deep working with controlled traffic farming** (mechanical amelioration with mitigation)

# Results for managing compaction

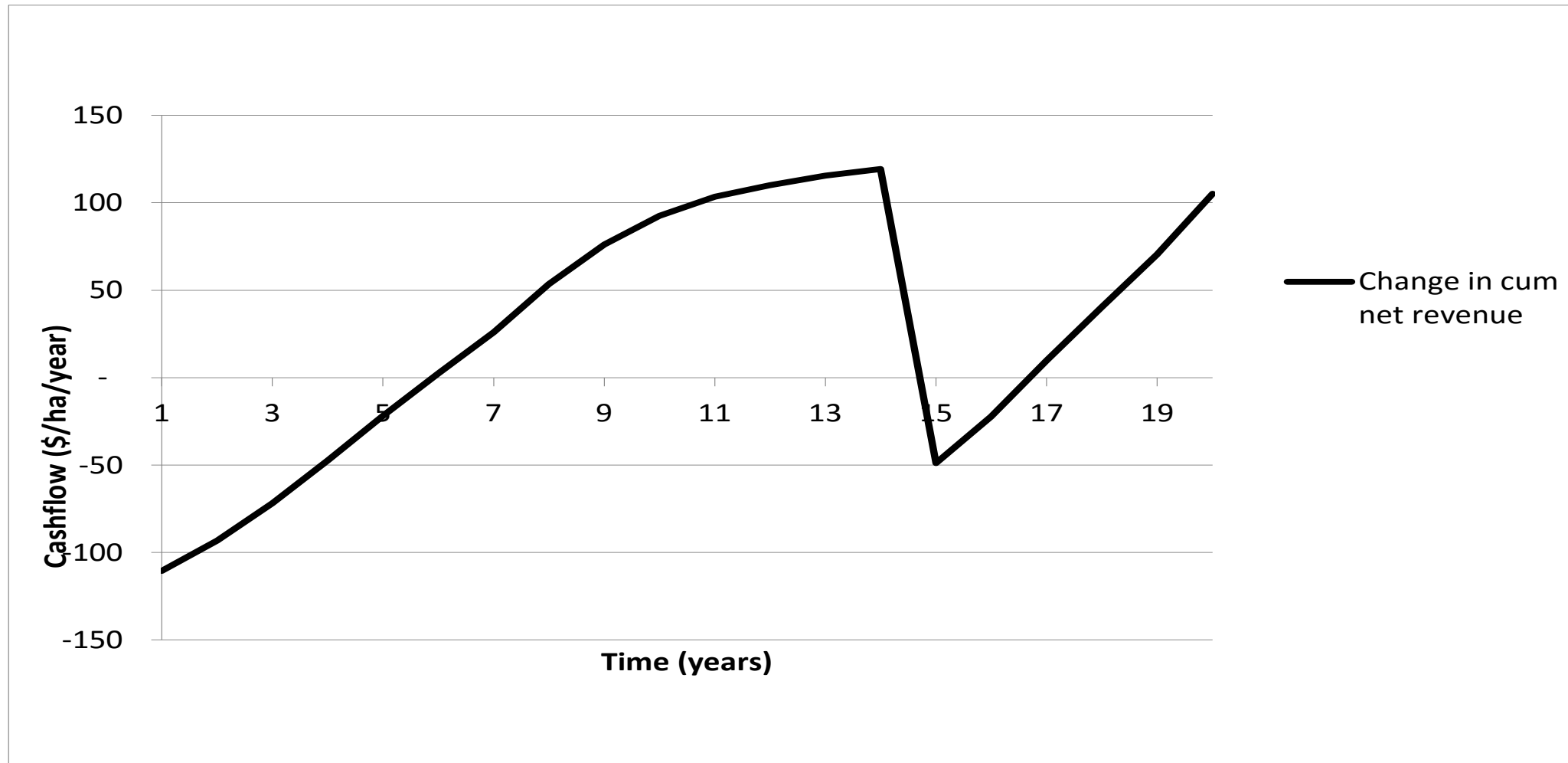
Indicative equivalent annual profit (\$/ha/year over 20 years)			Indicative benefit cost ratio (Over 20 years)		
DR/DW alone	DR/DW with gypsum	DR/DW with controlled traffic farming	DR/DW alone	DR/DW with gypsum	DR/DW with controlled traffic farming
3	-16	35	1.2	0.5	8.8

DR = Deep ripping, DW = Deep working

# Managing sodicity with gypsum



# Cashflow



# Results for managing sodicity

Indicative equivalent annual profit (\$/ha/year over 20 years)	Indicative benefit cost ratio (over 20 years)
9	1.4 : 1



# Take home messages

- Subsoil constraints have a **significant impact** on the WA grain industry
- This is **especially true for subsoil acidity**, but also for subsoil compaction and sodicity, and to a lesser extent, transient salinity
- Management strategies have potential to **partly recover** these losses

# Limitations

- Assumes each **subsoil constraint in isolation**. Doesn't account for multiple constraints
- **Snap shot** in time
- Includes **agricultural costs only**
- Costs in terms learning, investigation and understanding not included
- Assumes an **average year**
- Many **data** assumptions are **indicative** only

# Future research

- Many of the GrainsWest projects aim to **improve the accuracy and reliability of assumptions** (especially estimated yield penalties and boosts)
- Include **multiple constraints**
- Consider boron toxicity

# Sincere thanks to:

- **GRDC for funding the project:**
  - DAW00242 Subsoil constraints – understanding and management
- **DAFWA experts for providing advice:**
  - Dennis van Gool - mapping and area of susceptibility
  - Chris Gazey - subsoil acidity
  - James Hagan and Paul Blackwell - subsoil compaction
  - David Hall - subsoil sodicity
  - Ed Barrett-Lennard - transient salinity

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