

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.



A bioeconomic framework for phosphorus deepplacement decisions

Andrew Zull (DAF)

Mike Bell (QAAFI)

Howard Cox, Jayne Gentry, Kaara Klepper (DAF)

Chris Dowling (Back Paddock Co.)

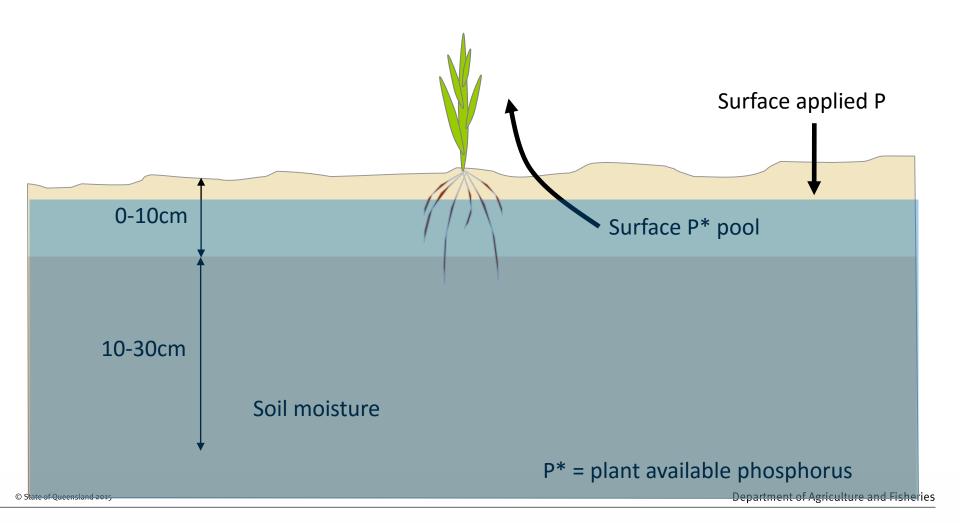
Contributed presentation at the 60th AARES Annual Conference, Canberra, ACT, 2-5 February 2016

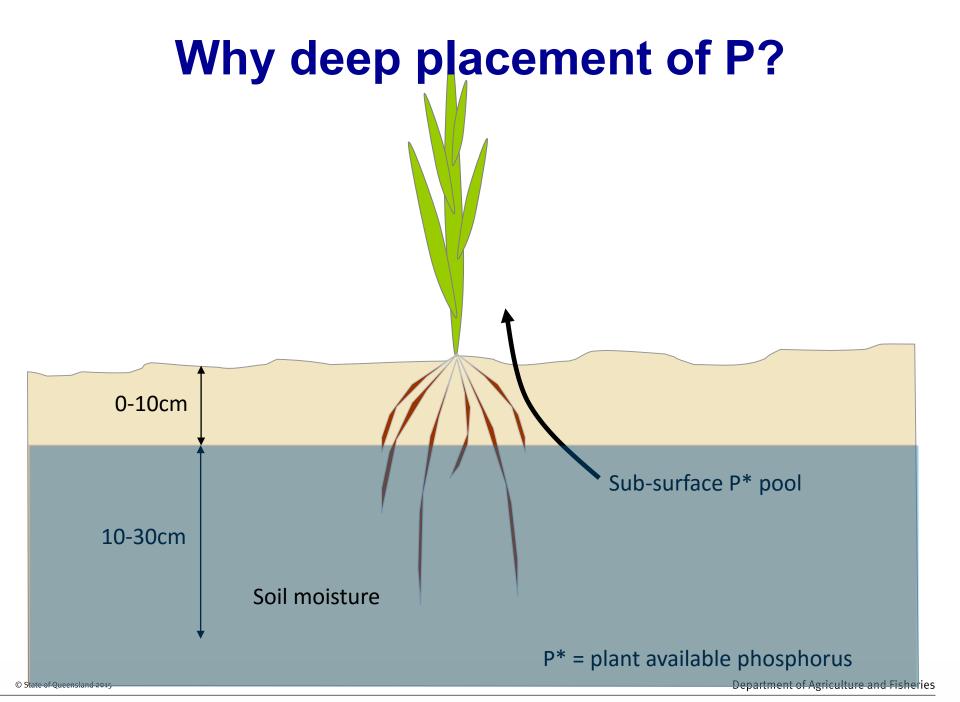
Copyright 2016 by Author(s). All rights reserved. Readers may make verbatim copies of this document for non-commercial purposes by any means, provided that this copyright notice appears on all such copies.

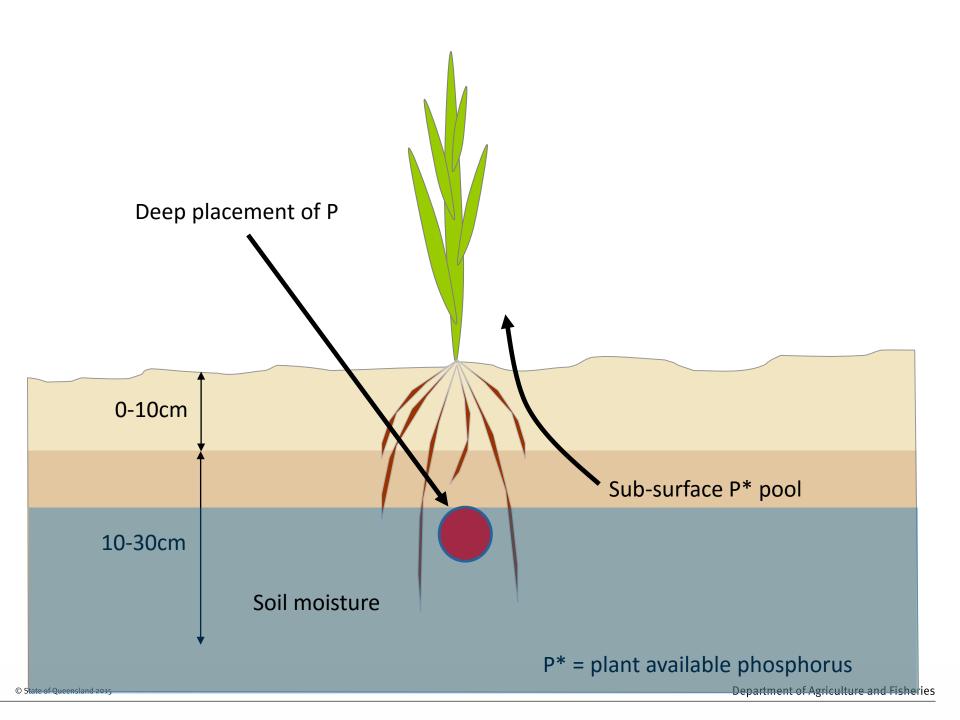


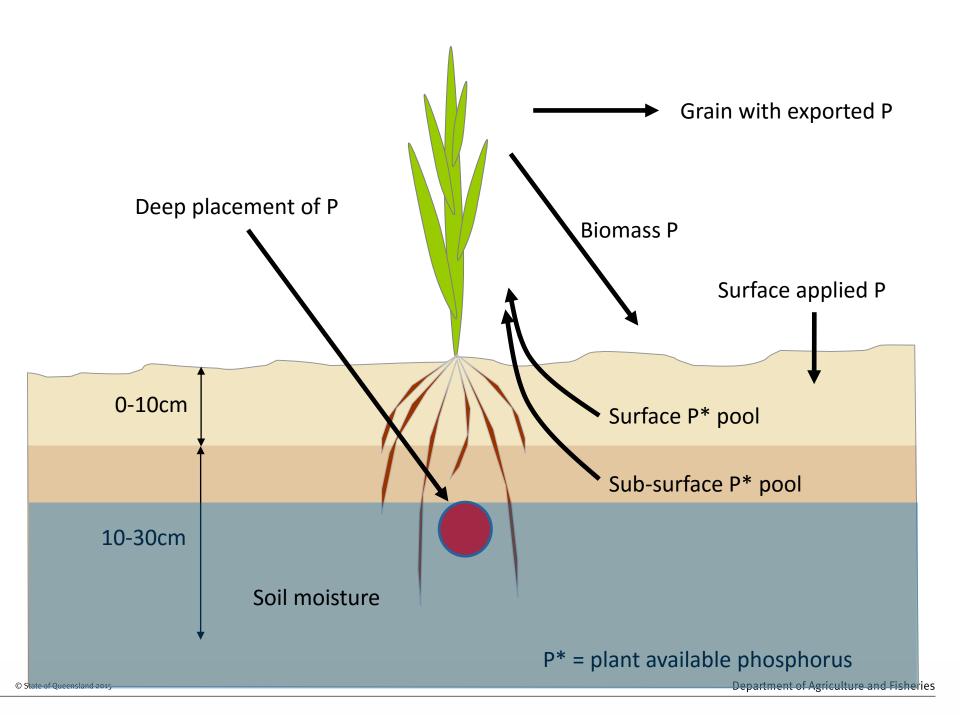


Why deep placement of P?









The BIG Deep-P Question

How much P? How often?

N & Starter P

 Short-term decision (current season) Deep-P

Long-term decision (many seasons)

N & Starter P

Deep-P

 Short-term decision (current season) Long-term decision (many seasons)

Known soil moisture

Unknown future soil moisture

N & Starter P

- Short-term decision (current season)
- Known soil moisture
- Fixed crop prices (can contract)

Deep-P

Long-term decision (many seasons)

Unknown soil moisture

Unknown future crop prices

N & Starter P

- Short-term decision (current season)
- Known soil moisture
- Fixed crop prices (can contract)
- Known N & P \$ at application

Deep-P

Long-term decision (many seasons)

Unknown soil moisture

Unknown future crop prices

Unknown future N & P\$

N & Starter P

- Short-term decision (current season)
- Known soil moisture
- Fixed crop prices (can contract)
- Known N & P \$ at application
- \$\$\$ in Bank

Deep-P

Long-term decision (many seasons)

Unknown soil moisture

Unknown future crop prices

Unknown future N & P\$

\$\$\$ in the ground

N & Starter P

- Short-term decision (current season)
- Known soil moisture
- Fixed crop prices (can contract)
- Known N & P \$ at application
- \$\$\$ in Bank

Deep-P

Long-term decision (many seasons)

Unknown soil moisture

Unknown future crop prices

Unknown future N & P\$

\$\$\$ in the ground

Paddock(s) biophysical

User inputs:

- Crops/rotations
- Paddock details including soil PAWC, P levels, & N levels

Paddock(s) biophysical

User inputs:

- Crops/rotations
- Paddock details including soil PAWC, P levels, & N levels



Potential responses to Deep-P

- 12 QLD and NSW sites
- 100 years climate data
- APSIM or user entered

Paddock(s) biophysical

User inputs:

- Crops/rotations
- Paddock details including soil PAWC, P levels, & N levels



Potential responses to Deep-P

- 12 QLD and NSW sites
- 100 years climate data
- APSIM or user entered

Economic inputs:

User inputs:

- Variable cost
- Grain prices
- Deep-P application costs
- MAP & Urea prices
- Financial discount rate

Paddock(s) biophysical

User inputs:

- Crops/rotations
- Paddock details including soil PAWC, P levels, & N levels

Cost/Benefit Calculator



Potential responses to Deep-P

- 12 QLD and NSW sites
- 100 years climate data
- APSIM or user entered

Economic inputs:

User inputs:

- Variable cost
- Grain prices
- Deep-P application costs
- MAP & Urea prices
- Financial discount rate

Paddock(s) biophysical

User inputs:

- Crops/rotations
- Paddock details including soil PAWC, P levels, & N levels

rocpons

Potential responses to Deep-P

- 12 QLD and NSW sites
- 100 years climate data
- APSIM or user entered

Economic inputs:

User inputs:

- Variable cost
- Grain prices
- Deep-P application costs
- MAP & Urea prices
- Financial discount rate

Cost/Benefit Calculator

Bio-economic outputs

- Optimal application rate
- Average real net gain \$/ha/year
- Risk of different decisions (\$)
 - Expected
 - Worst
 - Best
 - Breakeven
- IRR (rate of return %)
- Probable pay-back period

Paddock(s) biophysical

User inputs:

- Crops/rotations
- Paddock details including soil PAWC, P levels, & N levels



Potential responses to Deep-P

- 12 QLD and NSW sites
- 100 years climate data
- APSIM or user entered

Economic inputs:

User inputs:

- Variable cost
- Grain prices
- Deep-P application costs
- MAP & Urea prices
- Financial discount rate

Cost/Benefit Calculator

Bio-economic outputs

- Optimal application rate
- Average real net gain \$/ha/year
- Risk of different decisions (\$)
 - Expected
 - Worst
 - Best
 - Breakeven
- IRR (rate of return %)
- Probable pay-back period

A Case study: Goondiwindi

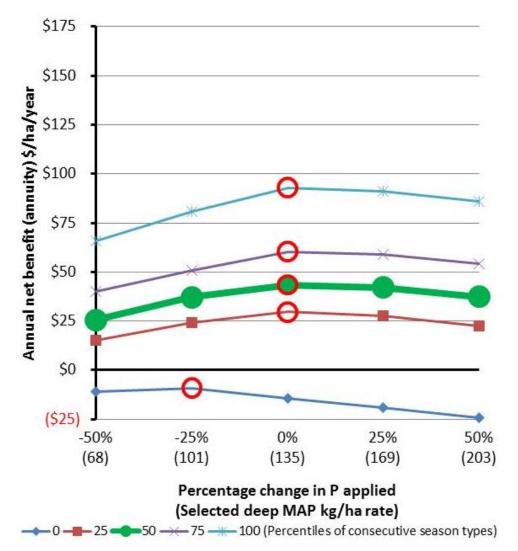
- PAWC = 180mm
- Soil PBI < 300 (P responsive)
- Sub-surface (10-30 cm) Colwell-P = 5mg/kg, BSES-P = 15mg/kg
- Cropping sequence
 - Short (3-years) --|SCP|-W|-W
 - Long (7-years) --|S CP| W| W| -|S CP| W| W
- Deep-P placement \$32/ha + P fertiliser

• MAP = \$730/t

	Reduction in yields if Colwell-P<10mg/kg) 180mm PAWC			Variable costs	Farm gate prices
Crops	Dry start	No stress	Dry finish	\$/ha	\$/t
Chickpea (dc)	18%	10%	20%	342	409
Sorghum (If)	8%	15%	18%	462	230
Wheat	8%	15%	18%	319	257

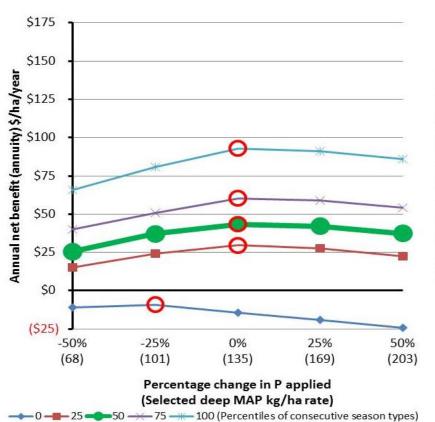
Results

Short cropping sequence (3 years) --|S CP|-W|-W



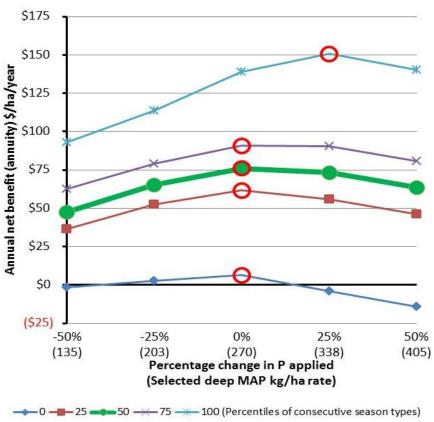
Results

Short cropping sequence (3-years)

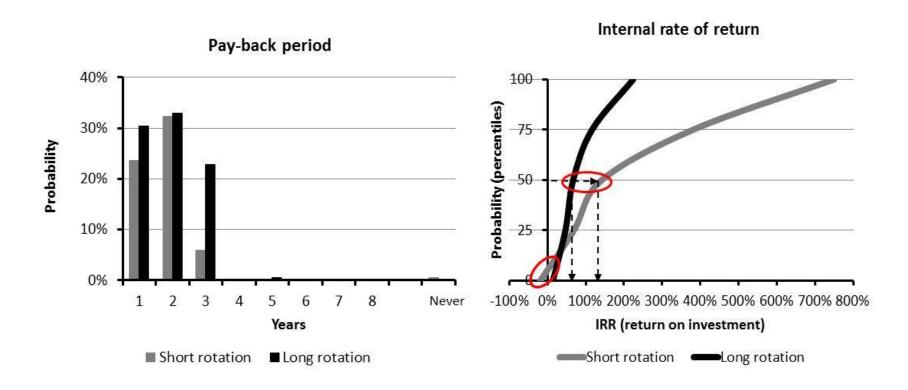


Long cropping sequence (7-years)

- -|S CP|- W|- W|- -|S CP|- W|- W



Results



Conclusion

How much P & how often?

Conclusion

Region:	Goondiwindi
PAWC:	180mm
Colwell-P test:	5mg/kg (10-30cm)

	Short sequence: 3-year	Long sequerce: 7-year
	S CP - W - W	S CP -W -W
		S CP - W - W
MAP applied:	135 kg/ha	270 kg/ha
Net benefit	\$43/ha/year	\$139/ha/year
Risk	Can have –ve ROI, no paid	Little risk
	back, & highly variable	
Expected pay back period	~2-years	~2-years
Expected ROI (IRR)	142% p.a.	67% p.a.

Other general learnings

Main drivers of Deep-P economics

- Is a *rainfed* cropping systems
- 2 Very **low Colwell-P and BSES-P** levels
- 3 High regional rainfalls4 High soil PAWC

Acknowledgement of GRDC support

The research undertaken as part of project [CSA00036, UQ00063] is made possible by the significant contributions of growers through both trial cooperation and the support of the GRDC, the author would like to thank them for their continued support.

Thank you

Dr. Andrew Zull

Agricultural- & Bio-Economist
Crop and Food Science
Agri-Science Queensland
Department of Agriculture and Fisheries
andrew.zull@daf.qld.gov.au