ACIAR's Contribution to Lowland Rice Technologies in Laos

John Mullen, Bill Malcolm and Bob Farquharson

NAFRI Anniversary Seminar April 26, 2019

Rice in Laos

- 700,000 families grow rice - semi-subsistence
- Lowland wet season rice – 80% of total
- Irrigated dry season rice - < 15%

- Every year part of the country affected by drought or flood
- Most rice has been hand transplanted

"My question is: Are we making an impact?"

This Impact Assessment

- Focus on 3 projects part funded by ACIAR, led by Prof. Shu Fukai from UQ with partners in Laos
- Projects ran from 1996 to 2012
- Aimed to improve welfare of lowland rice growers
  - developing varieties more tolerant of drought
  - Adapting direct seeding for use in Laos
  - Develop various forms of scientific capacity
  - Other objectives whose impact was likely small

- Reported in Mullen et al. (2019) IAS Report 97

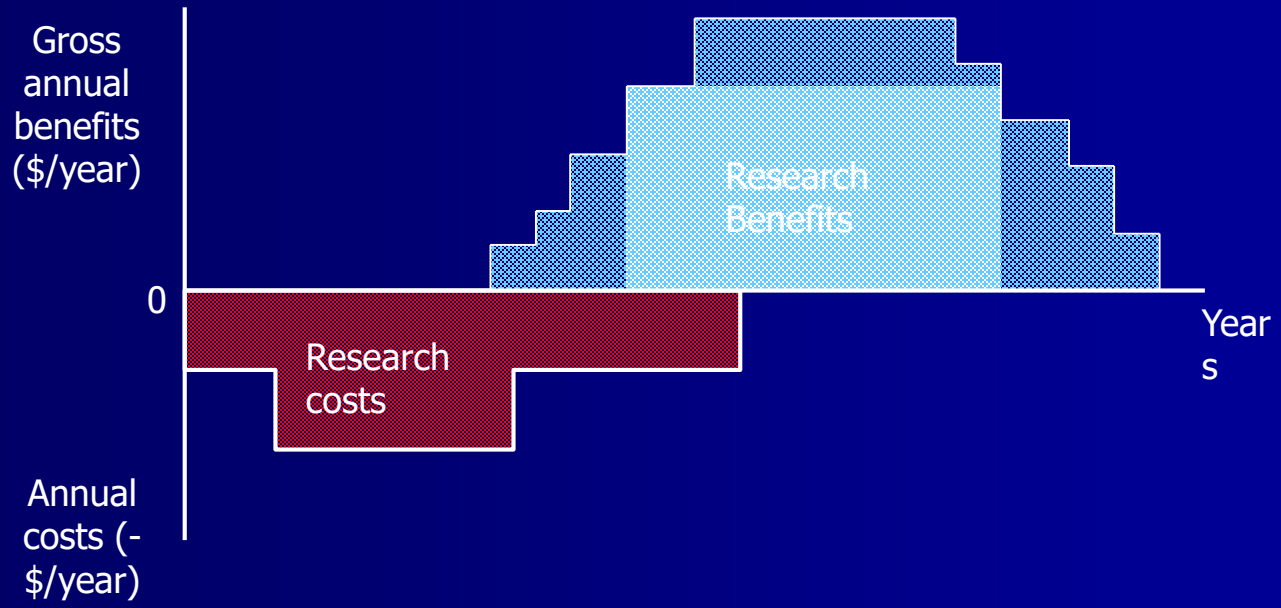
Drought Tolerant Varieties

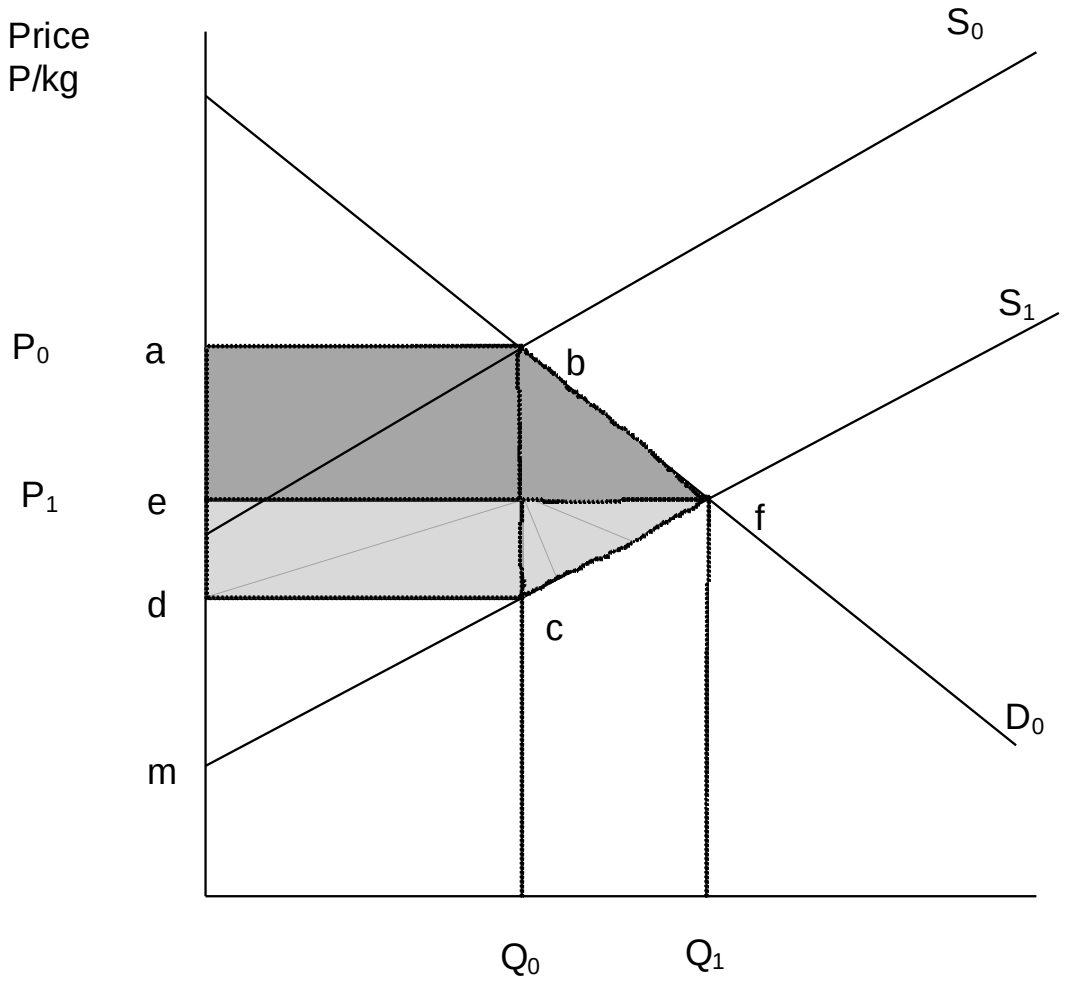
- Every year between 1966 and 2002 (37 years) 'at least part of the country was affected by either drought or flood,…….'.
- Incentive to develop varieties with a shorter growing season more tolerant of dry conditions
- 3 varieties released and 15 tested and adopted

Direct Seeding Technology

- Hand transplanting is onerous and labour intensive
- Labour has become scarce with economic dev'ment
- Direct seeding offers flexibility – dry seeding
- Weed control is a major hurdle
- Several methods of direct seeding

- **Successful research leads to a stream of benefits**
- **Lags between research, development and adoption**





Δ TS = Δ CS + Δ PS

= Po*Qo*k(1 + 0.5*Z*n)

n = 0.5, s = 1.5

Conventions used in our Analysis

- 5 % discount rate
- Real 2017 Values using Aust. & Laos GDP deflators
- Present values in 2017 obtained by compounding forward costs and returns prior to 2017 and discounting back returns after 2017 at 5%
- Real Laotian returns converted to $AUD at the exchange rate in 2017
- Elasticities: Demand 0.5 Supply 1.5

Economic Analysis

	Present Values mill. 2017 $AUD (5% discount rate)
Investment by ACIAR and partners	14.1
Benefits:	
Drought Tolerant Varieties	18.5
Direct Seeding	44.1
Total Benefits	62.6
Net Present Value	48.5
Benefit Cost Ratio	4.4:1
Internal Rate of Return	16.1%
Modified IRR (5%)	11.5%

Social Impact

- Direct Seeding releases family labour from onerous work
- There are off-farm opportunities at a market rate of 60,000 kip per day
- Not practical for all women and children to work off – farm
- Allows them to work on other enterprises, and household and leisure activities
- We have valued all labour released at 60,000 kip/day
- Risk in a semi subsistence context complicates this issue

Capacities Built

- 144 scientific and conferences papers, some cited 100 – 600 times
- Generic skills thru informal training included:
  - trial management; experimental design; data analysis; scientific writing; English language and presentation skills; Joining scientific networks
- Technical Skills also developed
- 18 people undertook postgraduate study – some funded by ACIAR – some returned to the project
- Farmer skills developed thru PVS trials

Plausible Causal Pathways

- Was the technology profitable on-farm?
- Was it adopted by farmers ?
- Why is it likely that the ACIAR team was influential?
- What share of benefits can be attributed to the ACIAR team?
- How would the industry have developed otherwise?

On – farm k-shifts

- Both technologies profitable enough to encourage significant adoption
- New varieties – yield gain of 5% translates to a k-shift of 0.33
- Direct seeding – cost savings net of yield losses gives a k – shift of 8.3% in WS and 9.7% in DS
- However both technologies are likely to have +ve and –ve impacts on the exposure of farm families to risk

On –farm Benefits per Hectare from New Varieties – Wet Season

	Existing Varieties	Without New Varieties
Yield	3,000 Kg/ha	2,850
Price	2,500 Kip/kg	2,500
Gross income	7,125,000	6,768,000
Variable Costs	5,540,000	5,540,000
Gross Margin	1,585,000	1,228,000
Unit Costs	1,847	1,994
Net Benefit - K	120 kip/ha	3.3%

On –farm Benefits per Hectare from Direct Seeding – Wet Season

	Existing Varieties	New Varieties
Yield	3,000 Kg/ha	2,700 kg/ha
Price	2,500 Kip/kg	2,500 Kip/kg
Gross income	7,125,000	6,412,500
Labour	75 days/ha	51 days/ha
Variable Costs	5,540,000	4,010,000
Gross Margin	1,585,000	2,402,500
Unit Costs	1,847	1,485
Net Benefit - K	208 kip/ha	8.3%

Adoption of Better Varieties

- TDK13, VTE450-2 (Vientiane 2) and TDK36 (Pakcheng 1) and TDK11
- Adoption started in 2008
- Projects finished in 2016
- 10% of production in lowland rice came from 'ACIAR' varieties starting in 2008;
- At least one of the ACIAR varieties was grown in the districts that responded to an informal survey

Adoption of Direct Seeding

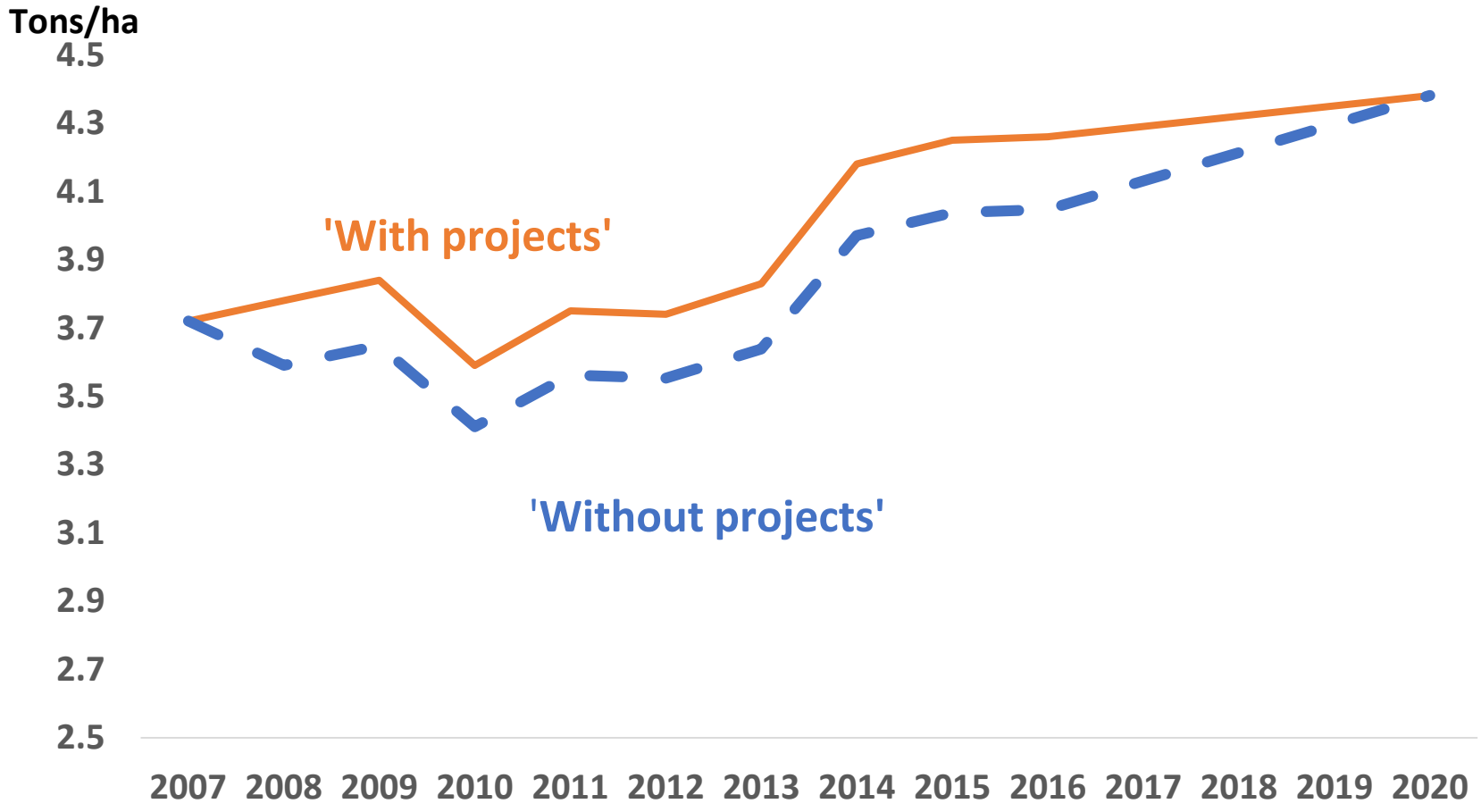
- Little data on adoption
- Fukai et al. suggested 50,000 ha in 2016
- No direct seeding before 2014
- 500,000 ha expected in 2026

The 'Without ACIAR' Scenarios

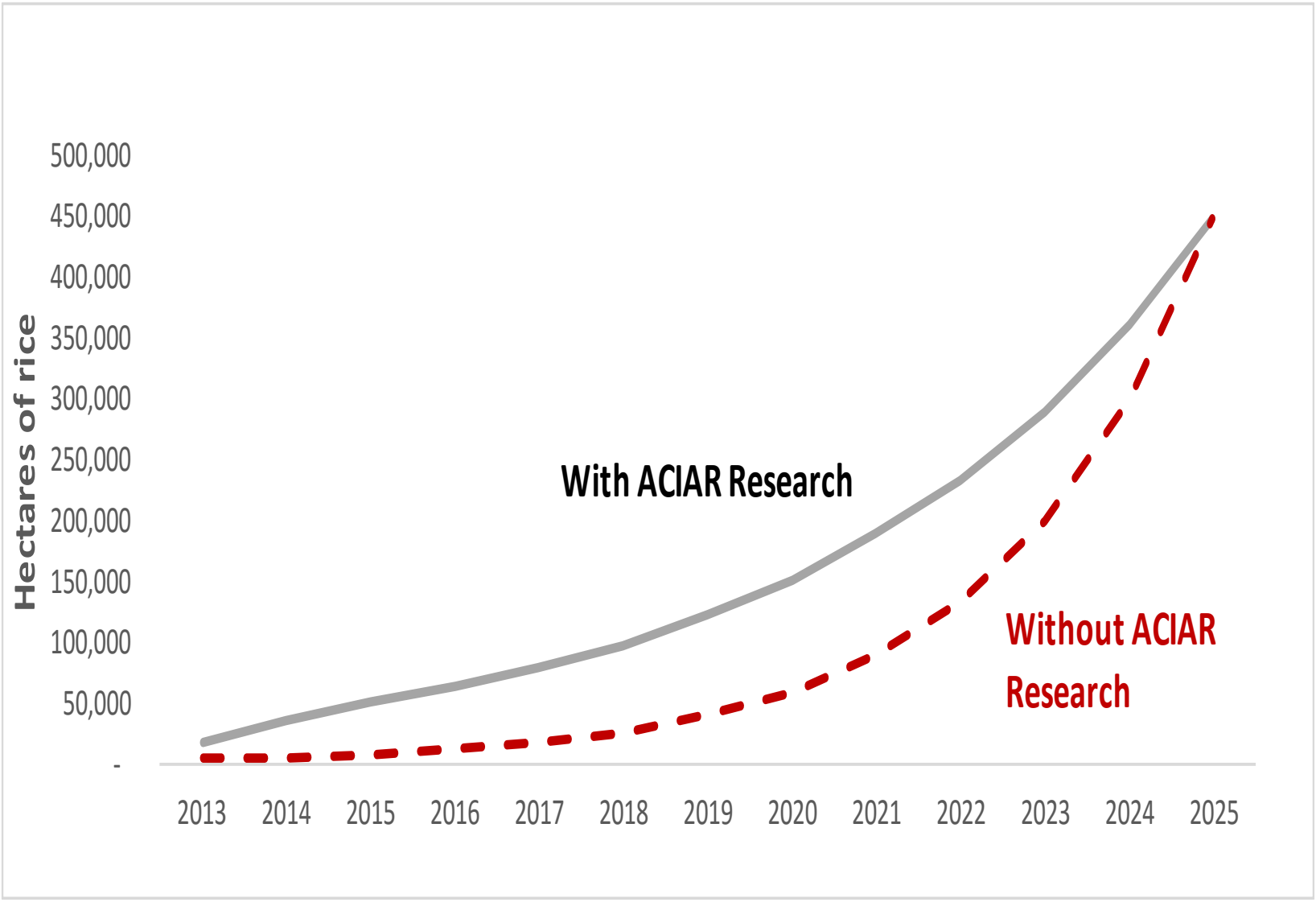
- "without project' yields grow more slowly but converge to 'with project' yields in 2020 as Fukai's influence on yield gains declined from 2016
  - Yields converge in 2020

- Fukai's basic direct seeding research still required hence
  - 5 year delay in commencement of adoption
  - Adoption converges to 500,000 ha in 2026

Yield Profile for Drought Tolerant Varieties



Adoption Profile for Direct Seeding



Why is it likely that the ACIAR team was influential?

- Technologies had to be adapted to Laos
- Fukai's skills in agronomy and physiology complemented Lao plant breeding skills
- Fukai built capacity in quantitative genetic methods
- Fukai did basic research for direct sowing
- Strong emphasis on farmer participatory research (about 800 farmers)
- Strong capacity building components
- The respect accorded Fukai in Laos was obvious to us

Benefits Attributable to ACIAR

- Lao plant breeders attributed 30% of the benefits from drought tolerant varieties to the ACIAR projects
- The basic research underlying direct seeding was undertaken. Later projects by others built on this work
- 60% of direct seeding benefits attributable to the ACIAR projects

Economic Analysis

	Present Values mill. 2017 $AUD (5% discount rate)
Investment by ACIAR and partners	14.1
Benefits:	
Drought Tolerant Varieties	18.5
Direct Seeding	44.1
Total Benefits	62.6
Net Present Value	48.5
Benefit Cost Ratio	4.4:1
Internal Rate of Return	16.1%
Modified IRR (5%)	11.5%

Conclusions

- This set of projects has been a good investment from ACIAR's perspective
- Data on adoption of the technologies and other parameters was scarce
- HOWEVER This finding is robust to halving key adoption and attribution parameters
- A full reports is available as ACIAR IAS No. 97