The Future of Rice Research and Development : towards 2028

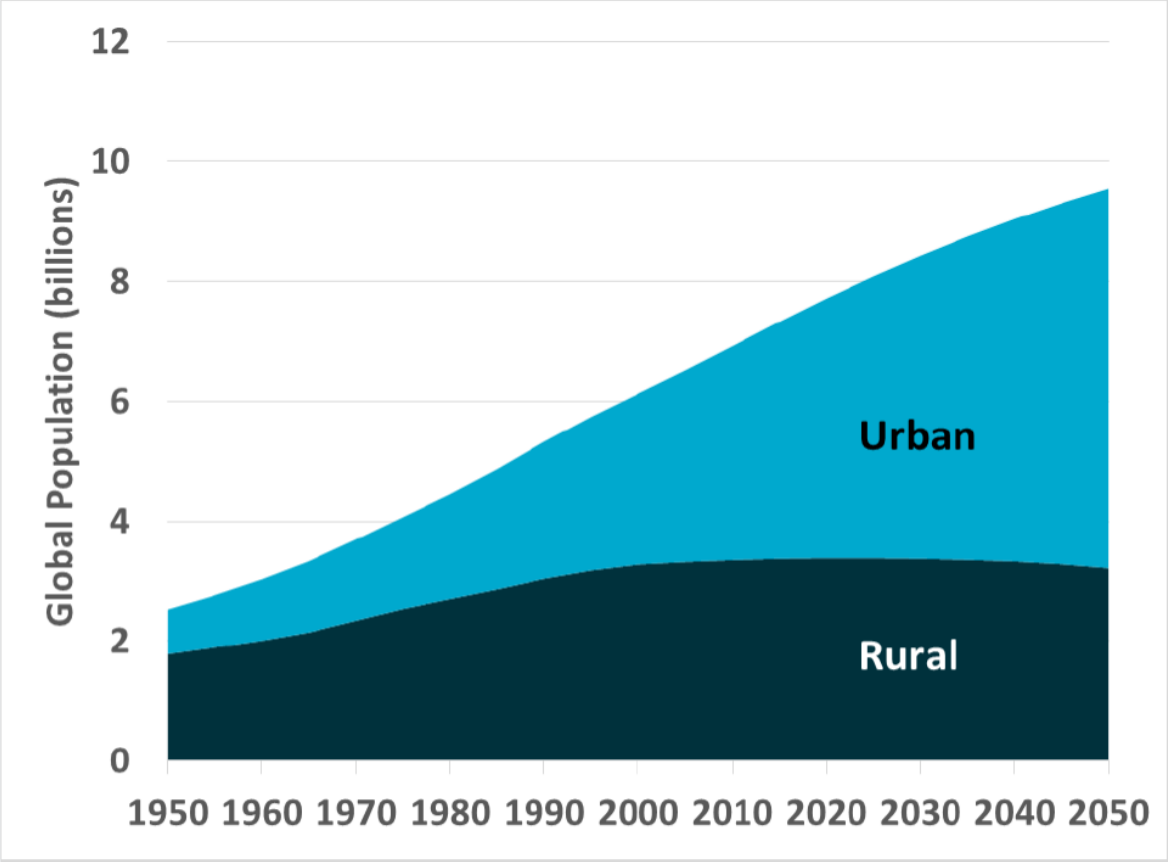
Russell Ford

SunRice

28th June 2018

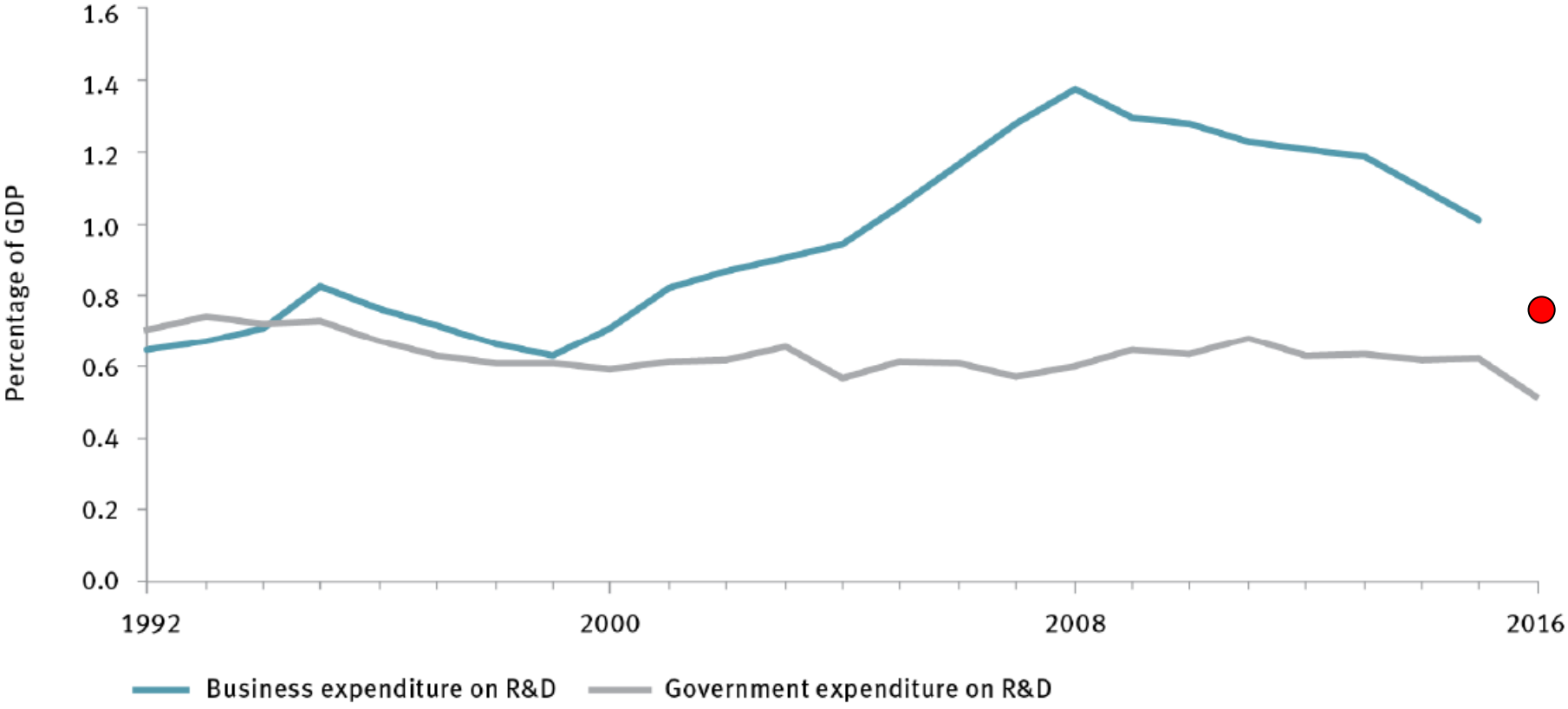
Urbanisation

Changes who needs to be fed – and their diet

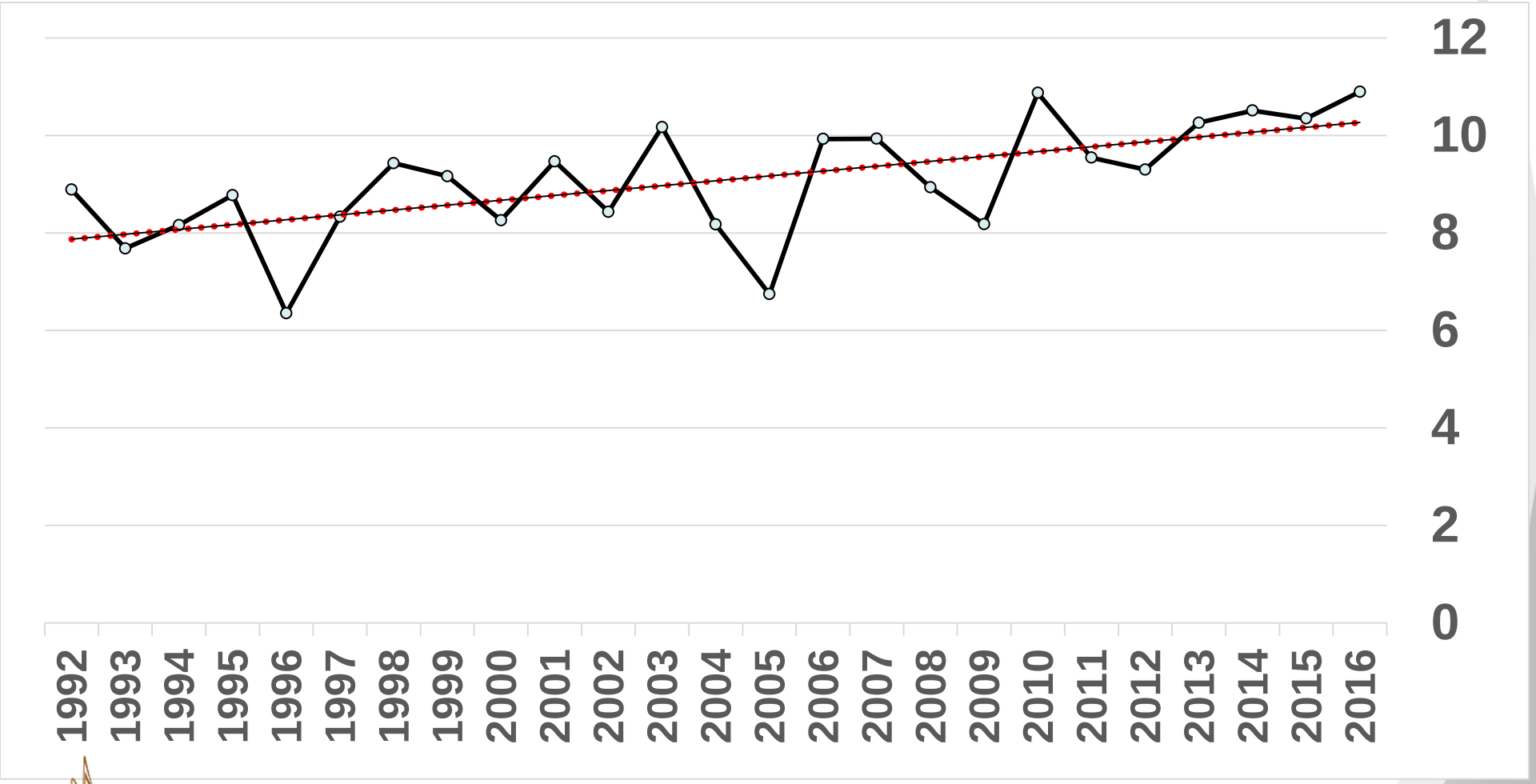


Imperative 2: Industry

Figure 12: Australian business and government research and development expenditure, 1992-2016

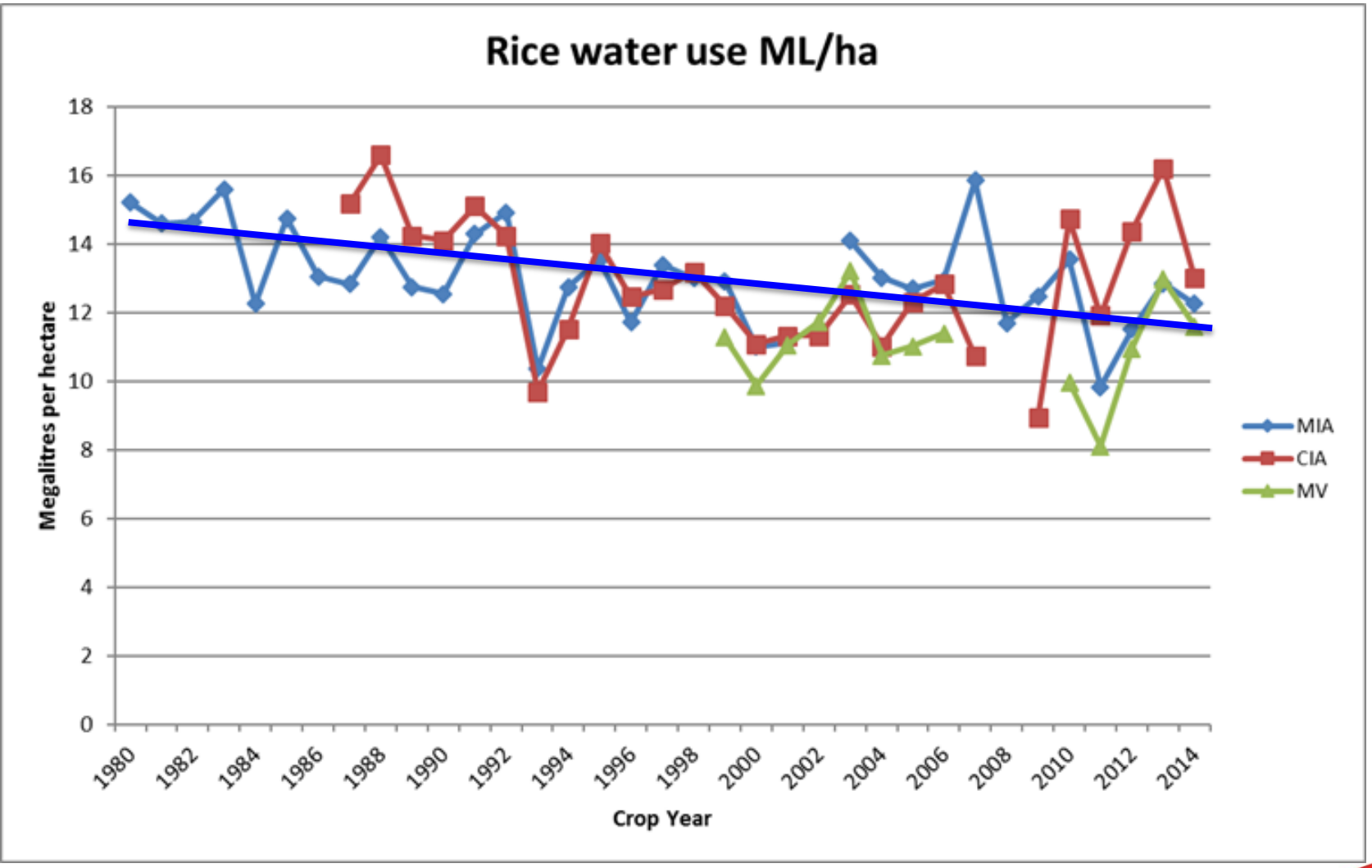


Average yield (Tonnes/Hectare)



Source: Rice Marketing Board 2016

Rice Water Use



RICE EXTENSION
FUNDED BY THE RURAL INDUSTRIES RESEARCH AND DEVELOPMENT CORPORATION

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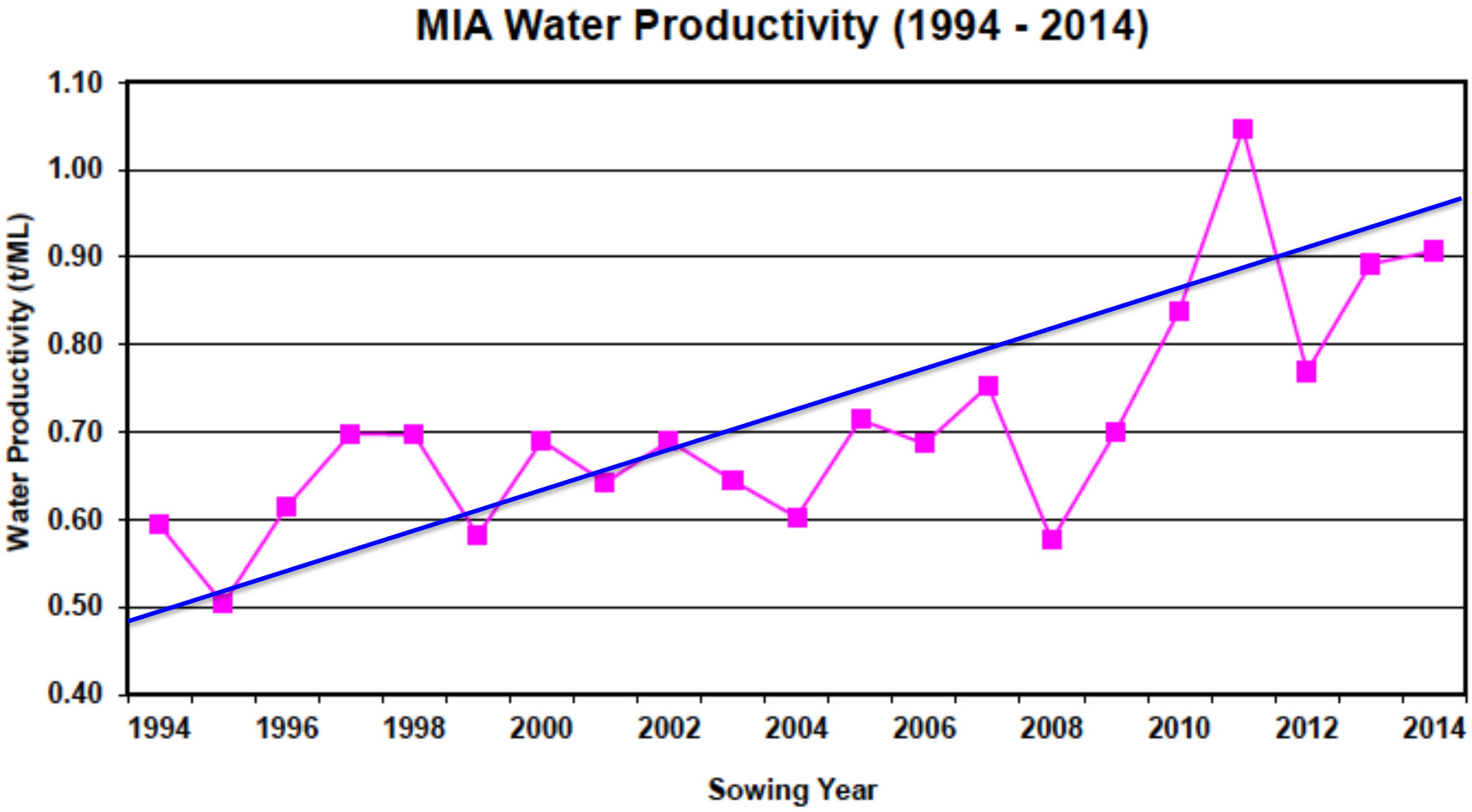
Water Productivity



Source: Murrumbidgee Irrigation Annual Environmental Compliance Reports and RMB Statistics

The Equation

1. Irrigation Layout
2. Variety
3. Seeding practices
4. Nutrition
5. Water management
6. Rotation (Farming System)
7. Herbicide selection and timing
8. Environment/Sustainability
9. Drainage
10. Harvest moisture
11. Drying
12. Storage
13. Grain Quality/Milling
14. Marketing
15. Consumer Satisfaction/Sensory

AGRONOMIC

$$\frac{\text{Tonnes x Quality}}{\text{Water Use}}$$

$

Processing Expertise
Market Knowledge
Consumer Acceptance

The Equation – R&D 2018

1. Irrigation Layout ✓
2. Variety ✓
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Processing Expertise
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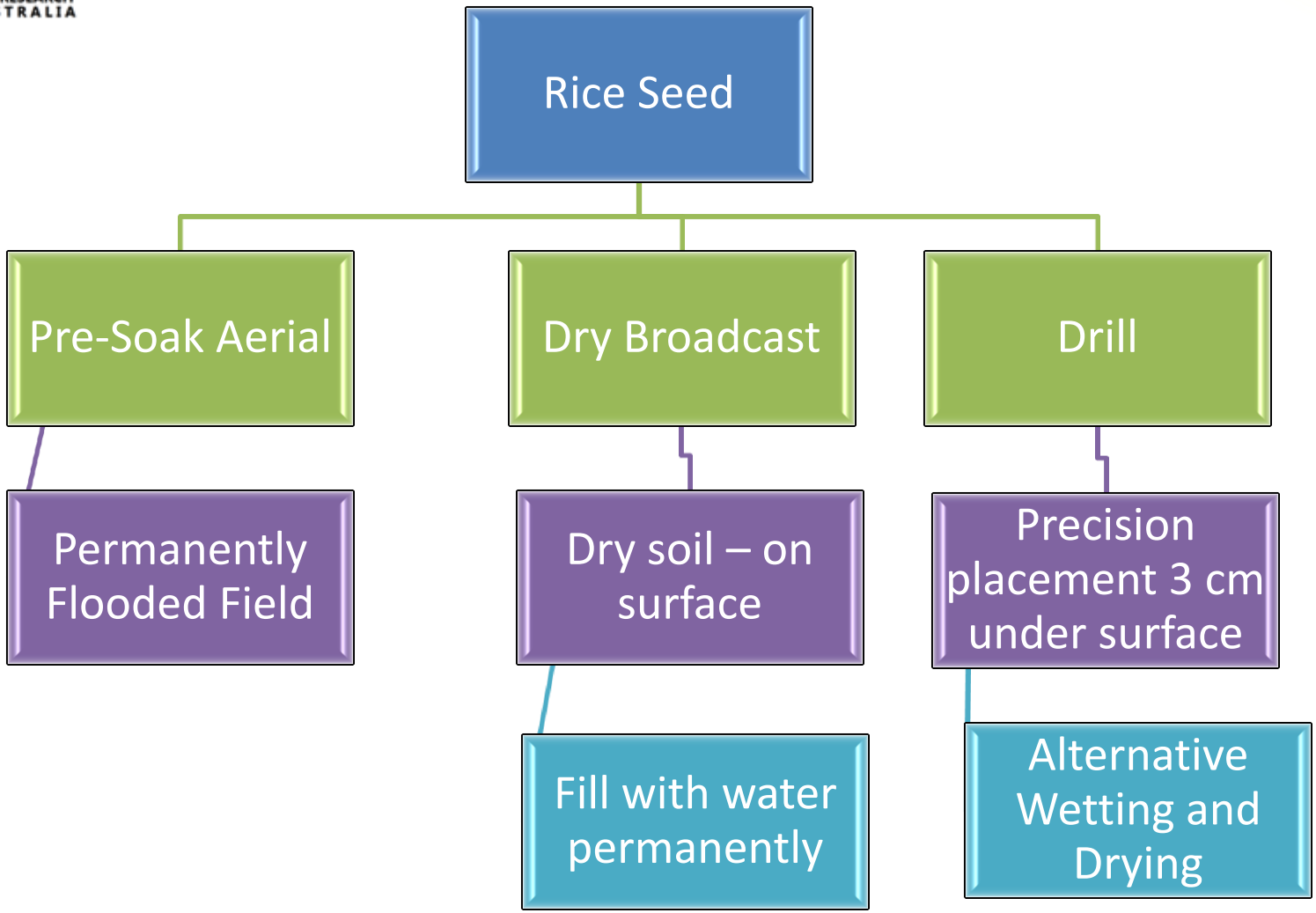
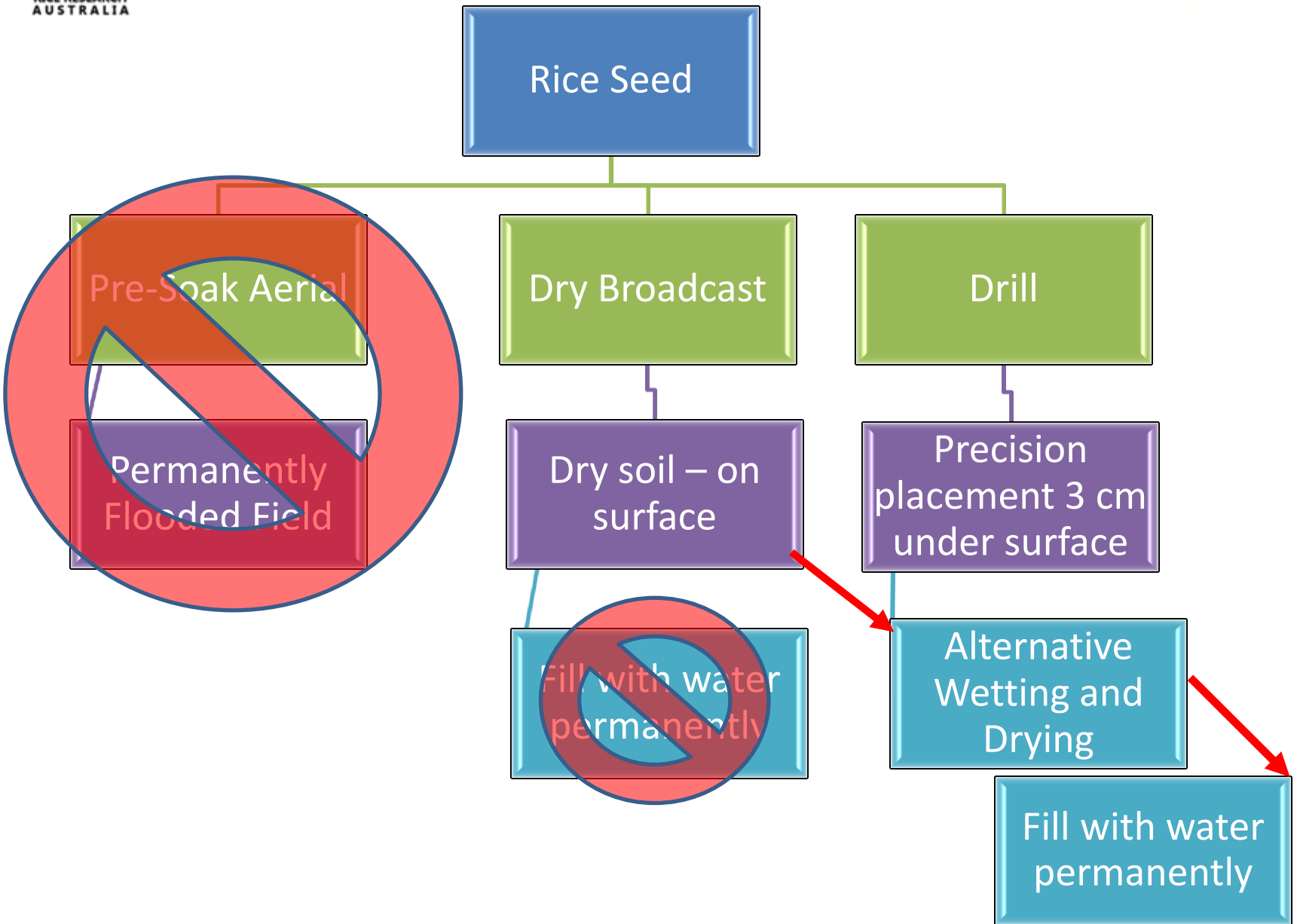
Sowing Systems for Rice in Australia



Sowing Systems for Rice in Australia 2028



Seeding Practices

Seeding & Irrigation Practices

Irrigation Layout x Variety Selection x Seeding System x Nutrition x Herbicide =

Establishment Variability <5%

Crop variability - RedEdge®

Legend

NDRE

- 0.10
- 0.13
- 0.17
- 0.20
- 0.24
- 0.28
- 0.31
- 0.35
- 0.39
- 0.42
- 0.46
- 0.50

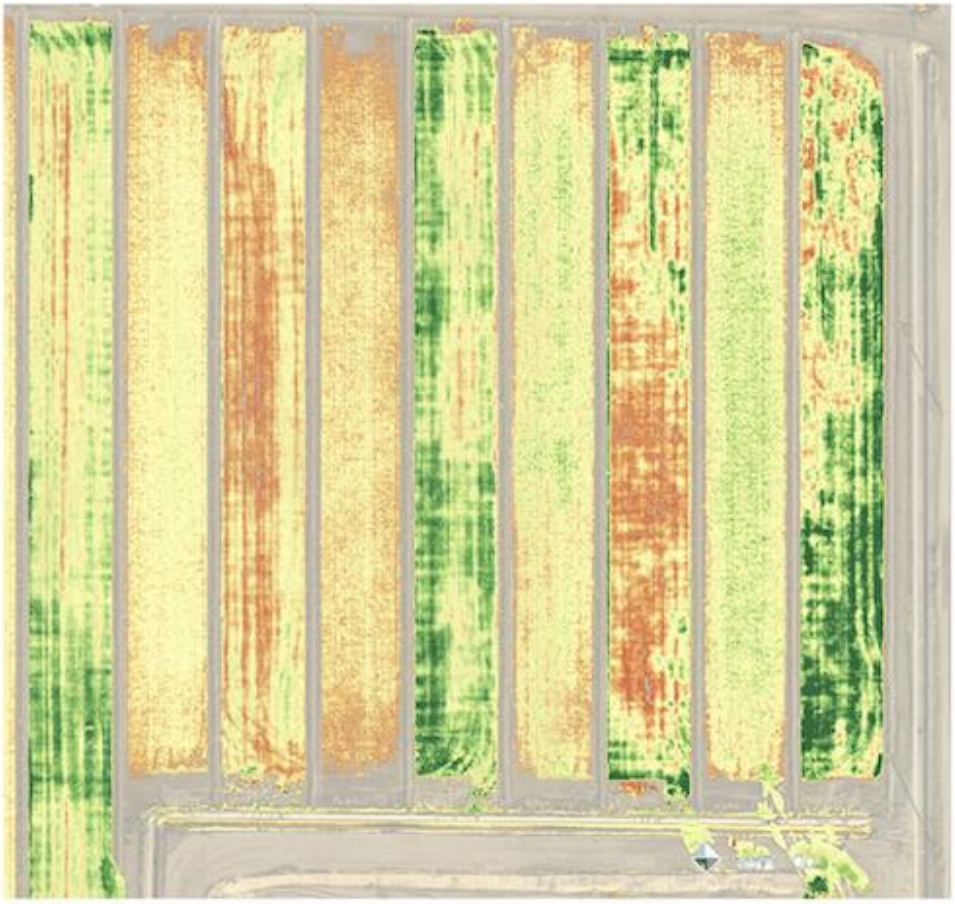
$$NDRE = \frac{[\ NIR - RED\ EDGE\ ]}{[\ NIR + RED\ EDGE\ ]}$$

Sensor: MicaSense RedEdge

Flight Altitude: 90 meters AGL

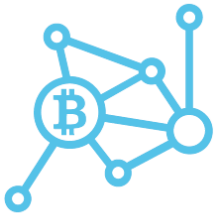
Average GSD: 6.1 cm/pixel (per band)

MicaSense RedEdge™



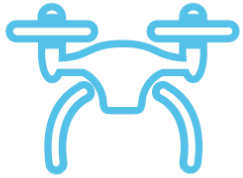
Technology & Data

CommBank's Emerging Technology Focus Areas



Blockchain

Analytics & Insights

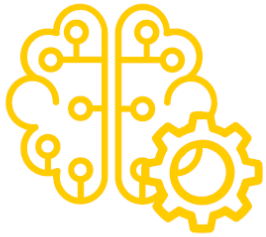


Drones & Robotics

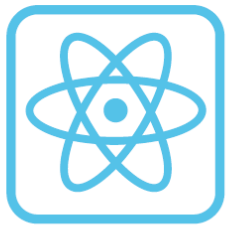
Augmented/ Virtual Reality

Internet of Things (IoT) & Machine to Machine (M2M)

Cyber Security & Trust



Artificial Intelligence & Machine Learning



Next-Gen Compute

Hectares sown by Variety by Date

	Amaroo	Doongara	Illabong	Koshihikari	Kyeema	Langi	Opus	Reiziq	Sherpa
21st to 30th September							300.65	59.49	35.36
1st to 10th October				101.69	142.56	137.2	588.35	1893.06	450.66
11th to 20th October		177.04		167.05	698.88	917.25	960.47	3681.64	1351.34
21st to 30th October	34.32		92.3	66.44	765.33	669.17	1162.79	2336.31	2681.24
31st October to 9th November	104.79		40.62	72.71	115.13	168.81	259.72	642.15	1751.81
10th - 19th November				56.39		123.55		119.16	414.43
20th - 29th November				53.85	29.06	172.33		154.2	79.85

RRAPL RICE RESEARCH AUSTRALIA

Sun RICE®

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Table 3. Recommended sowing/first flush dates for rice varieties, regions and sowing methods.

VARIETY	MIA/CIA - IDEAL SOW/FIRST FLUSH TIME			Murray Valley – IDEAL SOW/FIRST FLUSH TIME		
	Aerial / Dry Broadcast	Drill	Delayed permanent water	Aerial / Dry Broadcast	Drill	Delayed permanent water
Reiziq[A] Opus[A] Topaz[A] Doongara	25 Oct to 5 Nov	20 to 31 Oct	10 to 25 Oct	20 Oct to 5 Nov	15 to 25 Oct	5 to 20 Oct
Sherpa[A] Langi	25 Oct to 10 Nov	20 Oct to 5 Nov	10 to 30 Oct	20 Oct to 5 Nov	15 to 30 Oct	5 to 25 Oct
Koshihikari Illabong	-	-	-	20 to 30 Oct[#]	10 to 25 Oct	1 to 20 Oct
Viand[A]	10 to 30 Nov	5 to 25 Nov	1 to 20 Nov	5 to 30 Nov	1 to 20 Nov	25 Oct to 10 Nov
YRK5[A]	-	-	-	-	1 to 20 Nov	25 Oct to 10 Nov

Do not aerial sow or dry broadcast Koshihikari or YRK5 as this will increase lodging potential

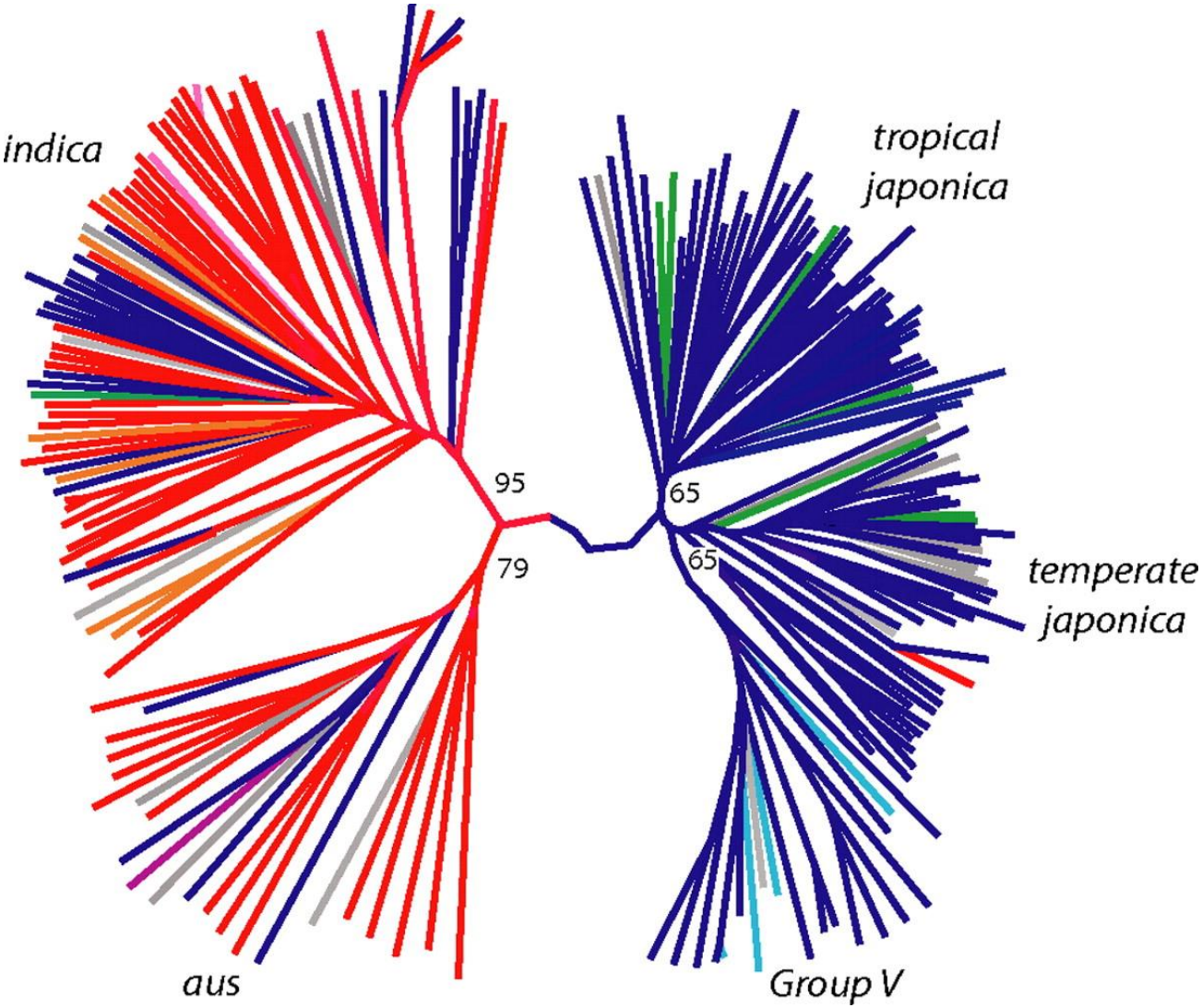
Variety Selection & Breeding

- Mainstream Medium Grain – Base Price
- Short Season – reduced water input
- Specialty – high value, low yield, low input, superior taste
- Constant focus on traits of grain quality, yield and water use efficiency

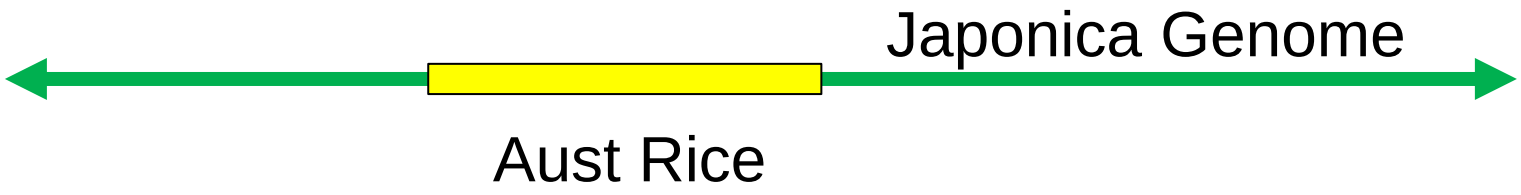
Variety Development - 2028

- Wide Diversity of Rice Genomes mapped
- Rapid Molecular Screening Systems
- Gene Editing without GMO ?
- Use of wider Genetic Base (Roots, Lodging, Drought)
- Fast response to consumer market indicators
- Healthy Rice (Low GI, Anthocyanin's, Antioxidants)
- Global Collaboration to improve efficiency of breeding and quality

The Genetic Split



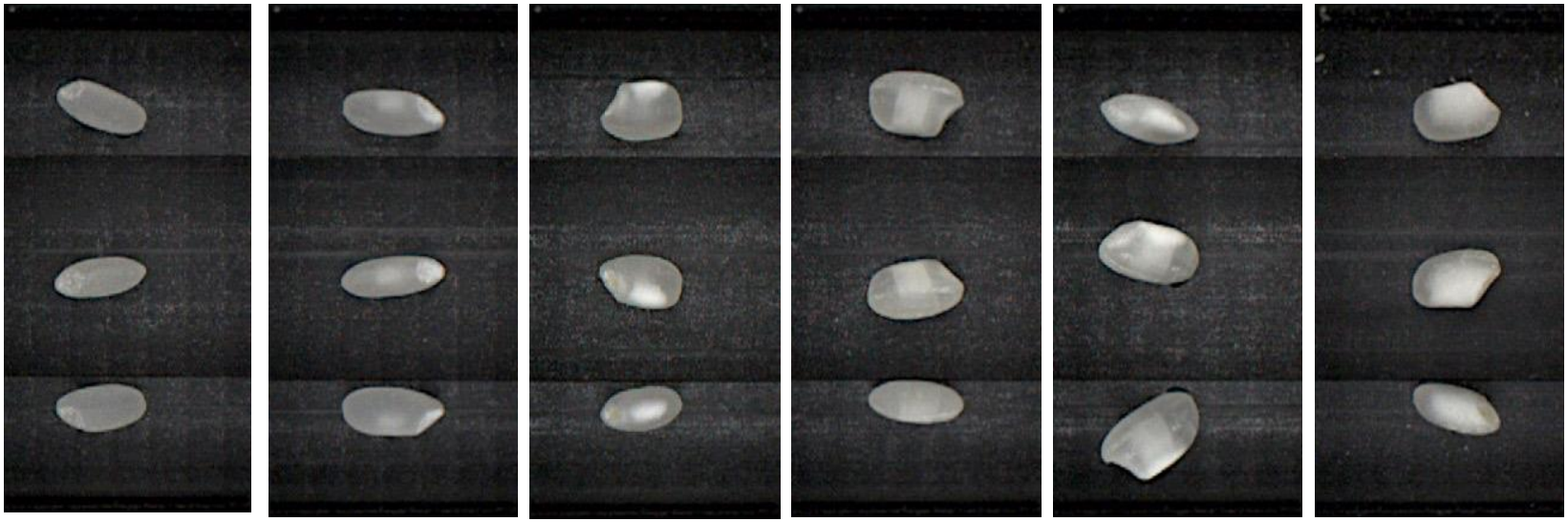
Domestic Base – lack of diversity

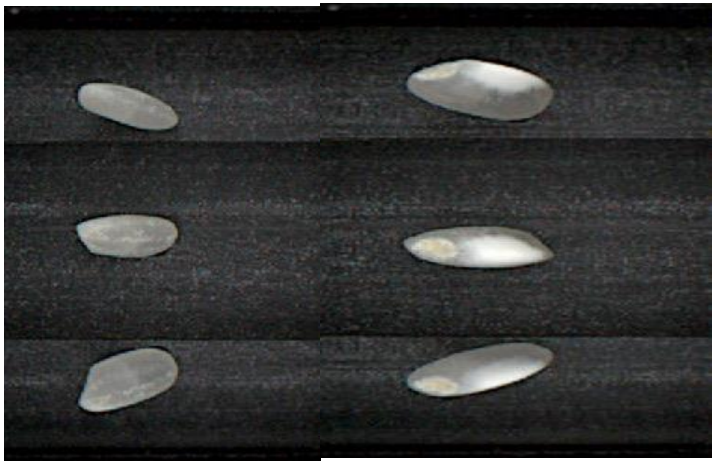



Sorter Explorer
1
2
3
1
2
3

Q sorter images

Translucent | 1 – 10% chalk | 10 – 25% | 25 – 50% | 50 – 75% | >75%

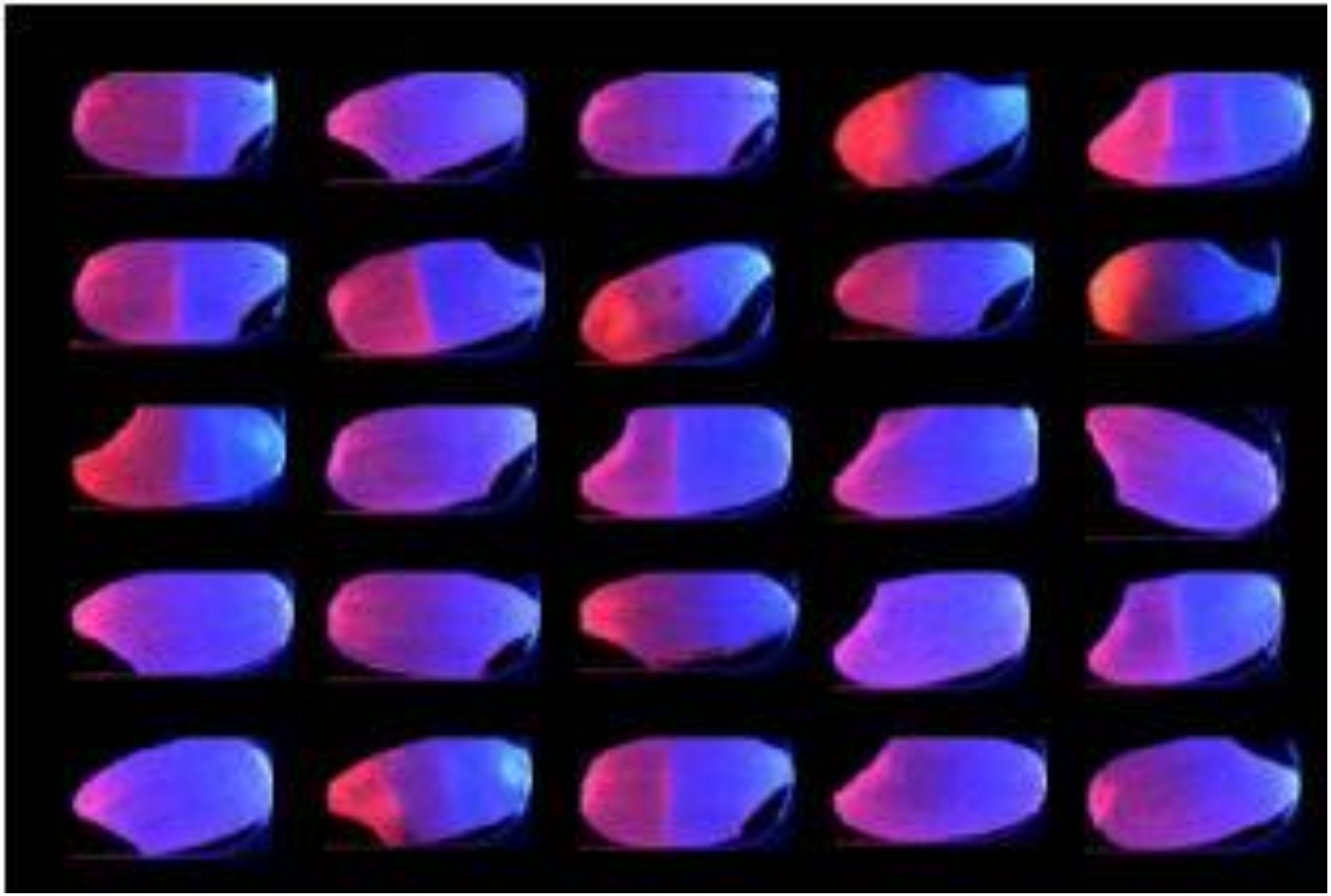




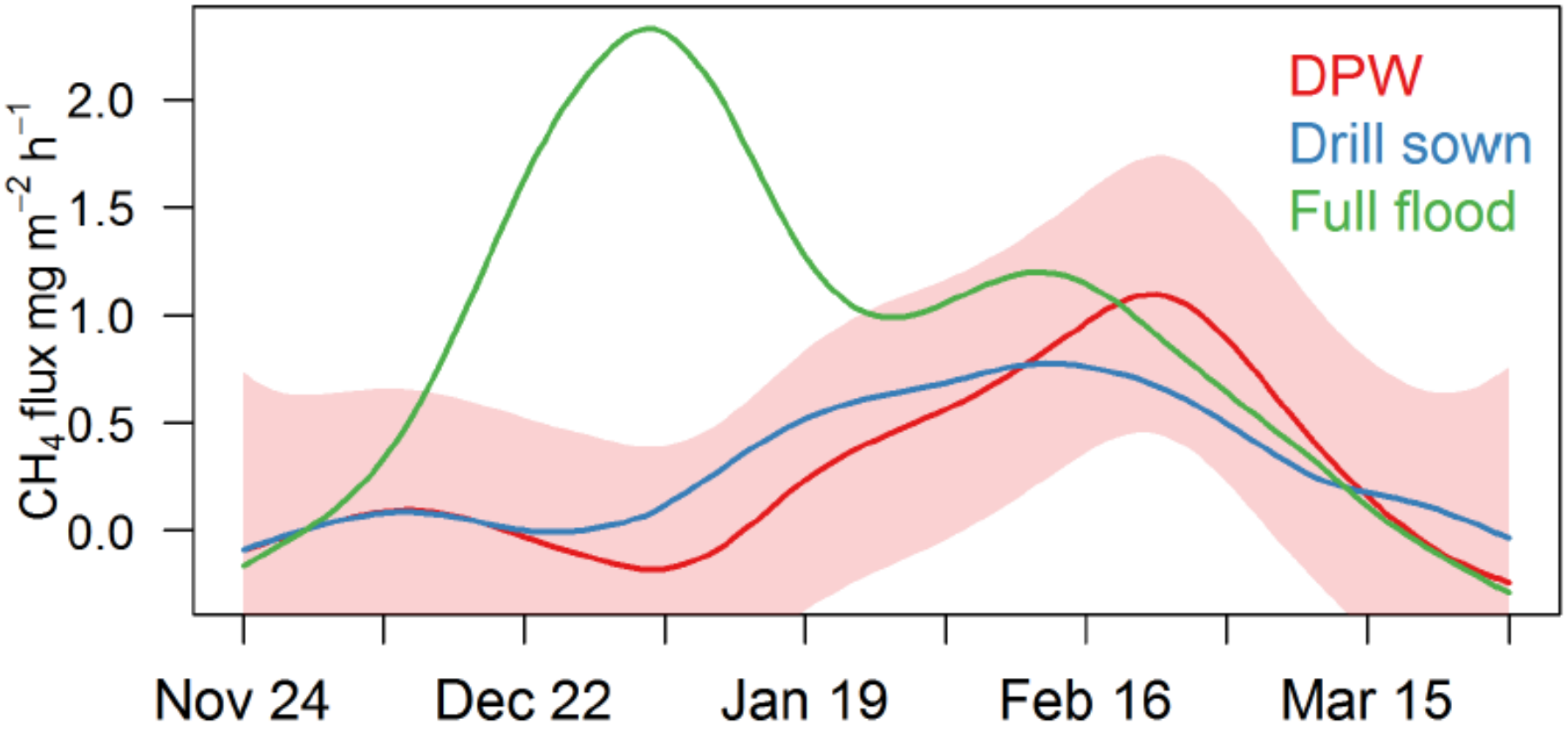
Cracks in brown rice

Chalk in brown rice….

And it measured cracks



Sustainability -Methane Emissions from Water Treatments



How do we compare?

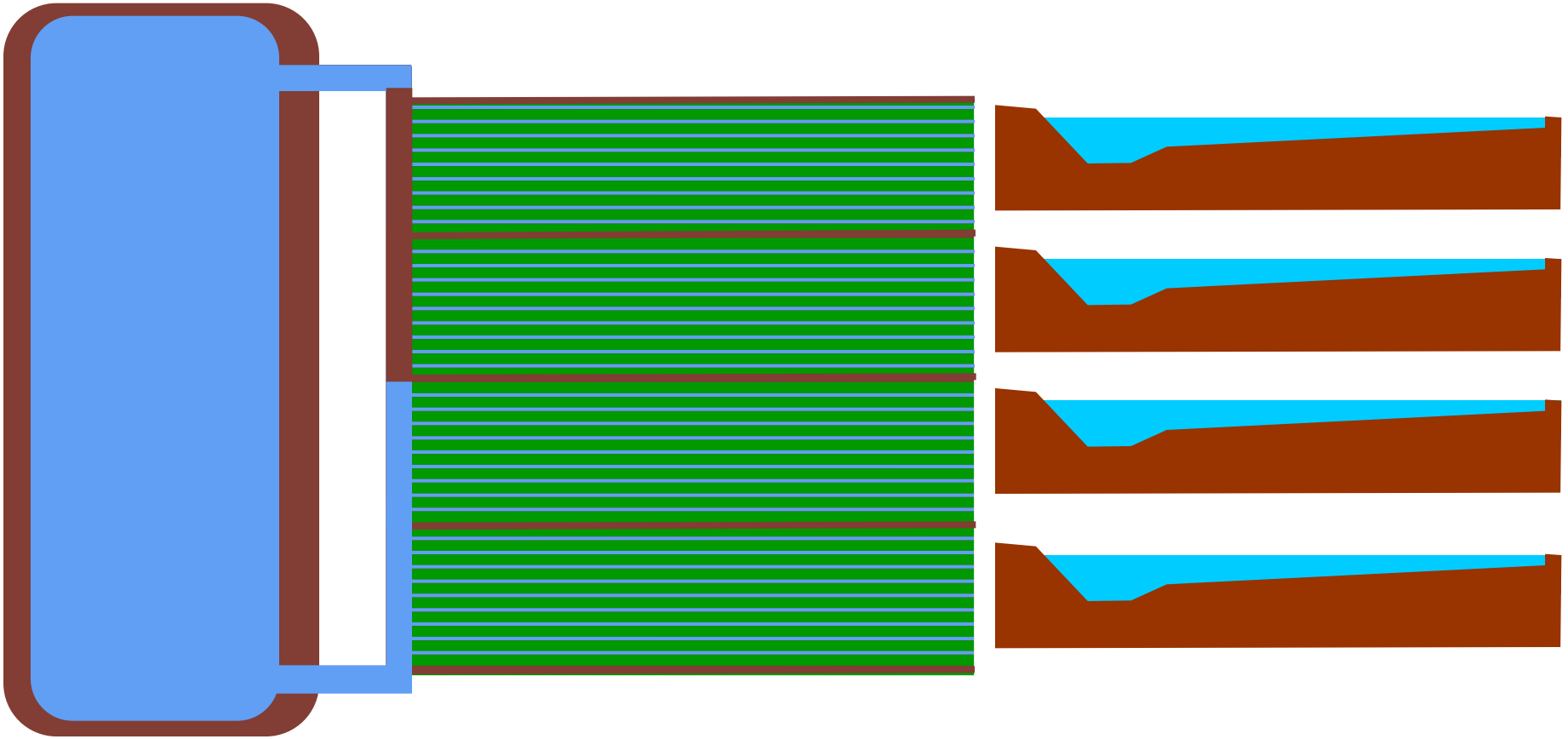
Water management trial – cumulative emissions

Treatment	CH_4 flux per season (g m^{-2})	N_2O flux per season (mg m^{-2})
Full flood	29.3 a	
Drill sown	11.8 b	Mean = 36.6
Early drain (DS)	12.2 b	
DPW	9.67 b	

IPPC methane emission data per country (g m^{-2} $season^{-1}$)

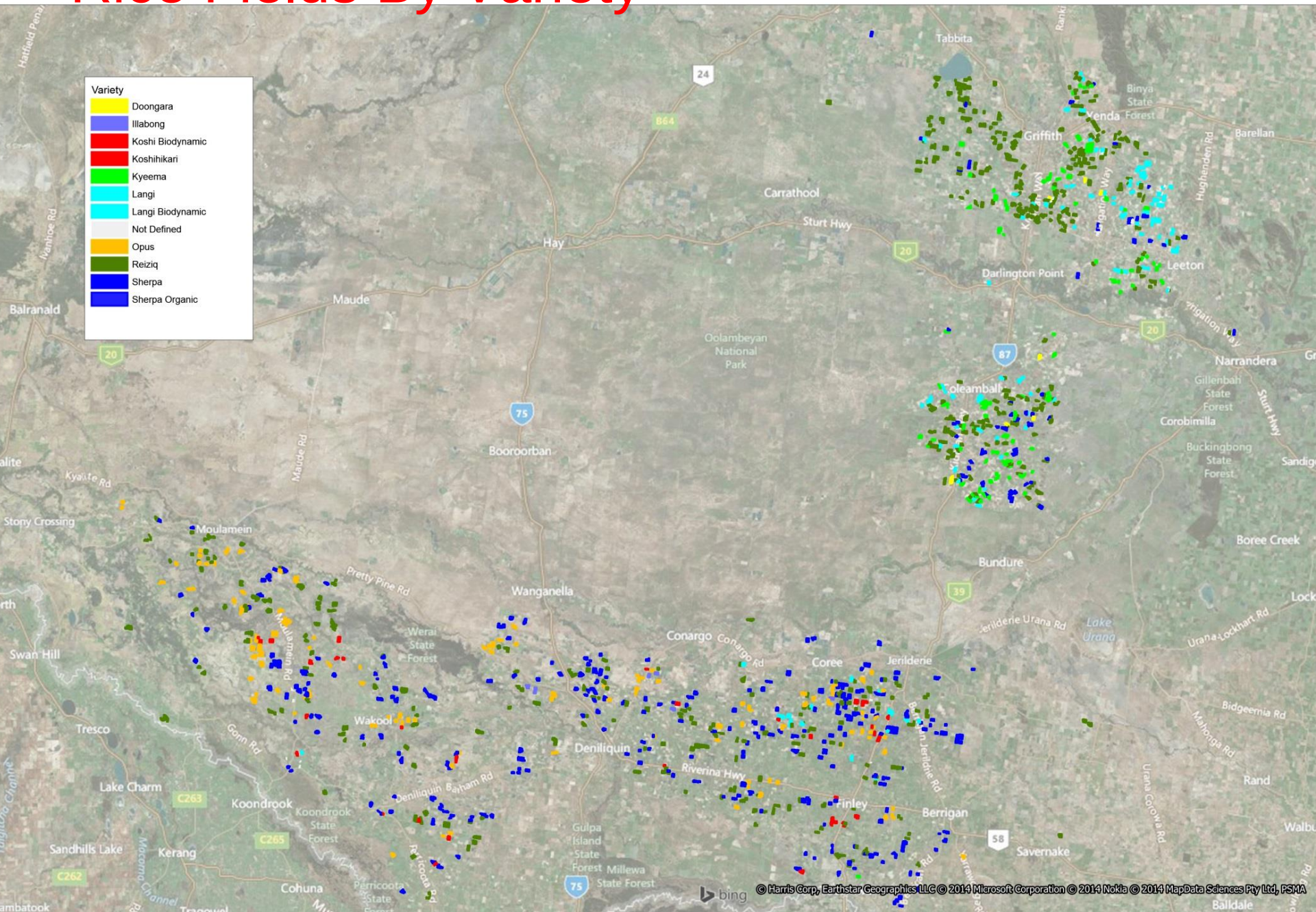
Country	Minimum	Median	Maximum
China	5	34	155
Indonesia	14	31	47
Japan	1		45
Thailand	34	48	86
USA	1	25	48
Korea	9	33	63

Smarter Water Control



Technology and Automation

Rice Fields By Variety



The future of Rice in the Riverina will need to see a distinct shift into the following areas:

1. High Value – breeding and marketing
2. High Yield – breeding and farming practices
3. Low water use – breeding (abiotic stress tolerance)
4. Short season - option
5. Reduce in-field variability – Precision Agriculture
6. Part of a high value rotation (maintain soil health)
7. Easily adopted into other farming systems (irrigation design and technology)
8. An efficient storage and processing system (designated delivery sites by variety)

Sun RICE Group

Tweet

Research is about taking risks and learning to trust yourself #3MT

27/6/18, 17:18

Tweet your reply

FUTURE TECHNOLOGIES

RRAPL
RICE RESEARCH AUSTRALIA

4号機打上げ QZS-4 launch

1機体制 Single-satellite constellation

4機体制 Four-satellite constellation

No one will protect what they don't care about, and no one will care about what they have never experienced.

— David Attenborough —

AZ QUOTES