



Department of
Agriculture and Food



On behalf of the Cotton Cooperative
Research Centre, Cotton RDC &
Australian cotton industry

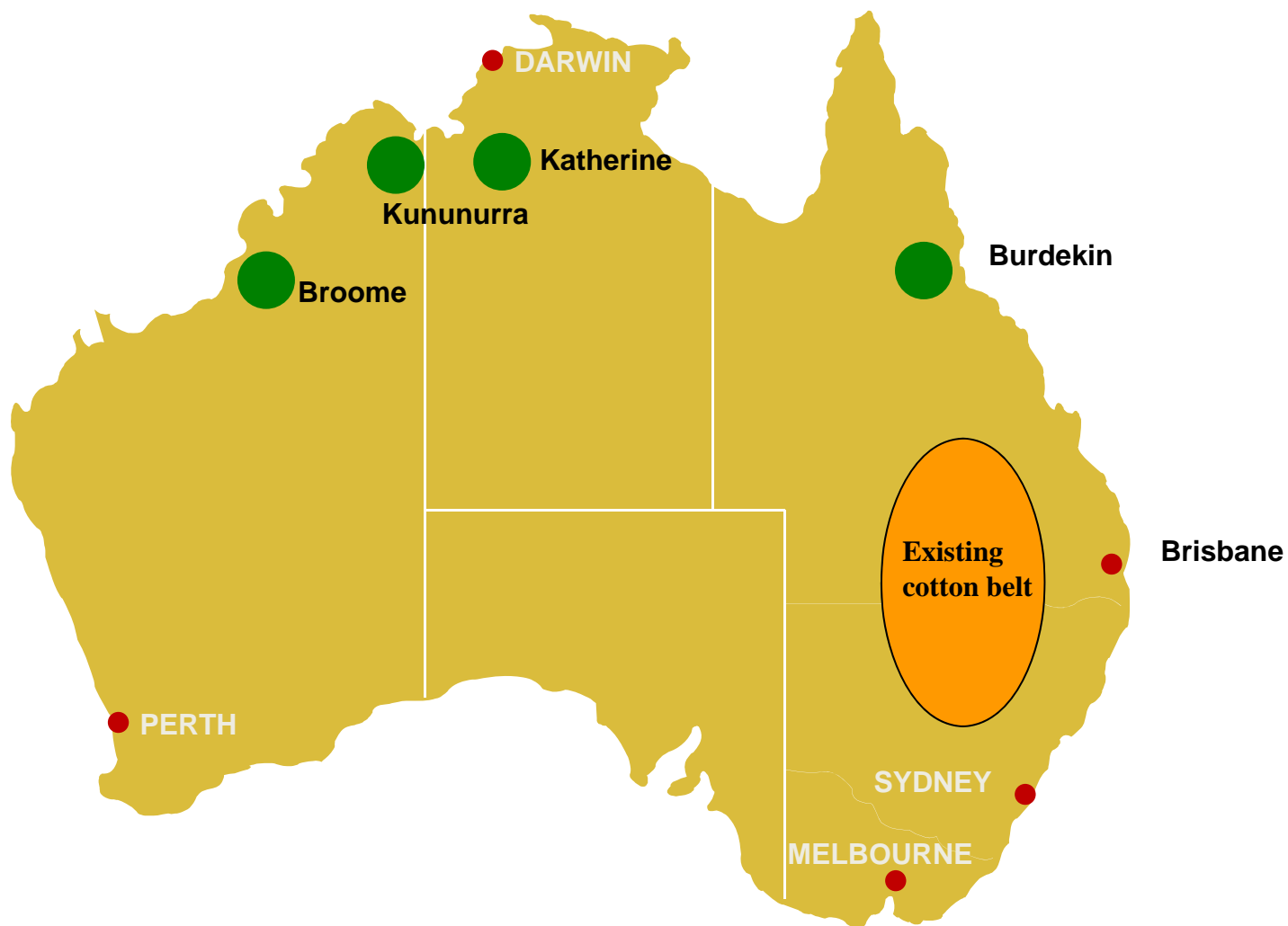
Supporting your success

Cotton research in northern Australia

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Research locations



Key issues for discussion

- some history – the bad old days.....
- the research challenge
- transformational science
 - novel pest management systems
 - agronomic adaptation
 - regulatory approvals
- conclusions





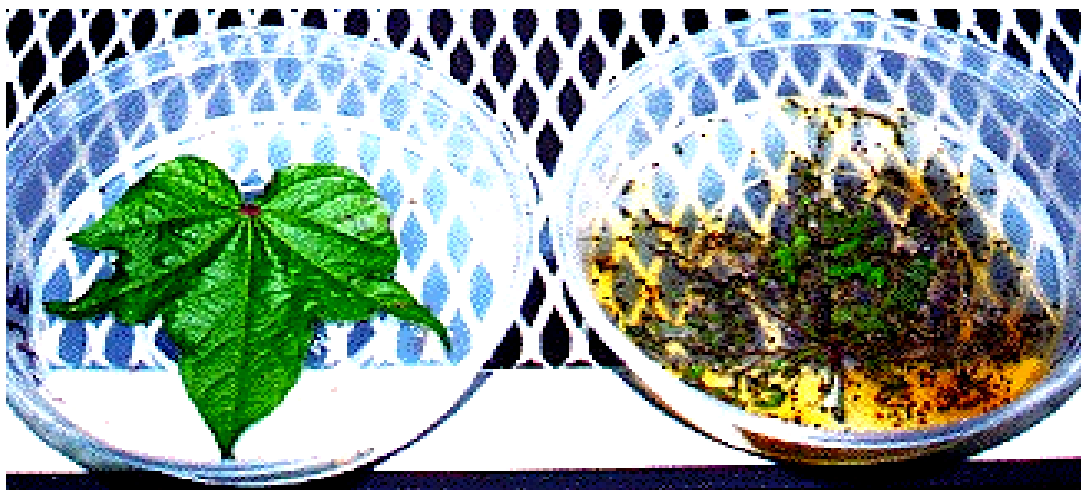
History of cotton at Kununurra

YEAR	NO. SPRAYS	INSECTICIDE KG /HA	MAJOR PEST	YIELD (LINT KG/HA)
1964	12	13	<i>H. punctigera</i>	417
1965	12	12	<i>S. litura</i>	712
1966	15	12	<i>H. punctigera</i>	889
1967	17	15	<i>E. huegeli</i>	851
1968	21	16	<i>S. litura</i>	823
1969	16	13	<i>H. punctigera</i>	955
1970	20	18	<i>Heliothis spp.</i>	1026
1971	21	27	<i>H. armigera</i>	1082
1972	25	35	<i>H. armigera</i>	917
1973	33	64	<i>H. armigera</i>	888
1974	40	77	<i>H. armigera</i>	660

Supporting your success

Biotechnology (GM) cotton – the game changer

- Australian bred cotton with extra genes added by biotechnology
- Bollgard II cotton has two genes from a soil bacteria called “Bt”
 - protection against caterpillar pests
- Roundup Ready Flex cotton has two genes from a bacteria
 - tolerance to Roundup herbicide



Supporting your success

Features of 1970s cotton industry - Kununurra

- summer cropping
- conventional varieties
- broad spectrum insecticides
- no resistance management

Components of sustainable cotton production

- winter cropping - to avoid pests
- transgenic “Bt” varieties
- IPM systems
- pre-emptive “Bt” resistance management





Essential components of IPM in the Kimberley

- grow in winter to avoid key pests
- use GM technology
- adopt IPM principles
- resistance management strategy





*Long term IPM yields - Kununurra

Treatment	Aphid sprays	Mirid sprays	Heliothis sprays	Total sprays	Average yield (kg lint/ha)
INGARD® alone	0.21	1.14	3.10	4.45	1491
INGARD® + IPM treatments	0.24	0.92	2.60	3.67	1501

* Averages from on farm trials 1996-2001; total area >3000 hectares





Winter IPM cotton – can it yield?

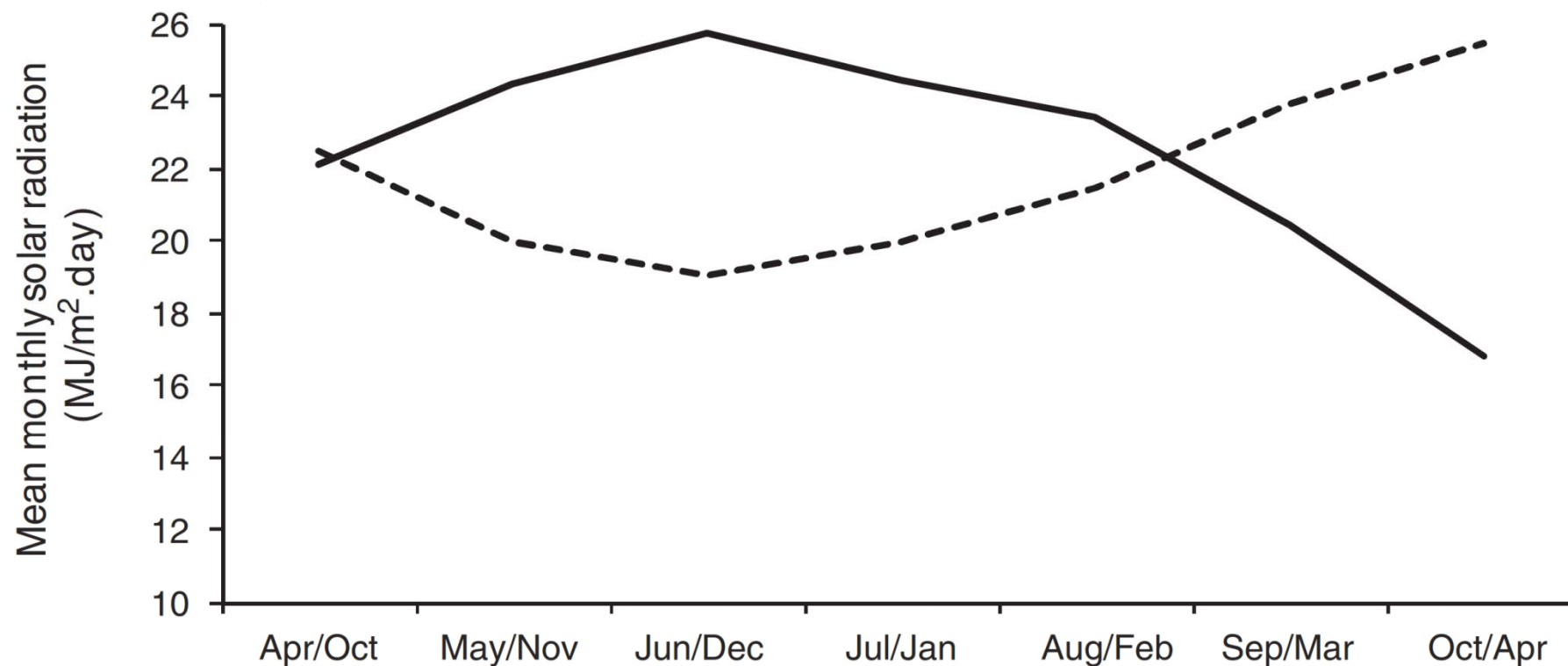
Yields from commercial scale IPM paddocks at Kununurra compared to Australian average yield (kg lint/hectare)

Year	Lowest yield	Highest yield	Australian average yield (irrigated)
1997	1112	2088	1946
1998	1544	2111	1546
1999	885	1748	1545
2000	1339	1952	1666
2001	445	1870	1785



Winter cotton is challenging!!

Solar radiation levels at Kununurra ----- Narrabri —————



“Reverse season” means:

- variety performance is different
- irrigation management changes
- Pix is risky....
- “cold shock” nights require management
- nutrition is different
- late and end of season management critical



Paddock scale validation of NORpak – Ord commercial production package compared to Australian average lint yield

Year	Ord yield	Australian average yield
2003	1952	2011
2004	1907	1995
2005	2247	2281
2006	1975	1901



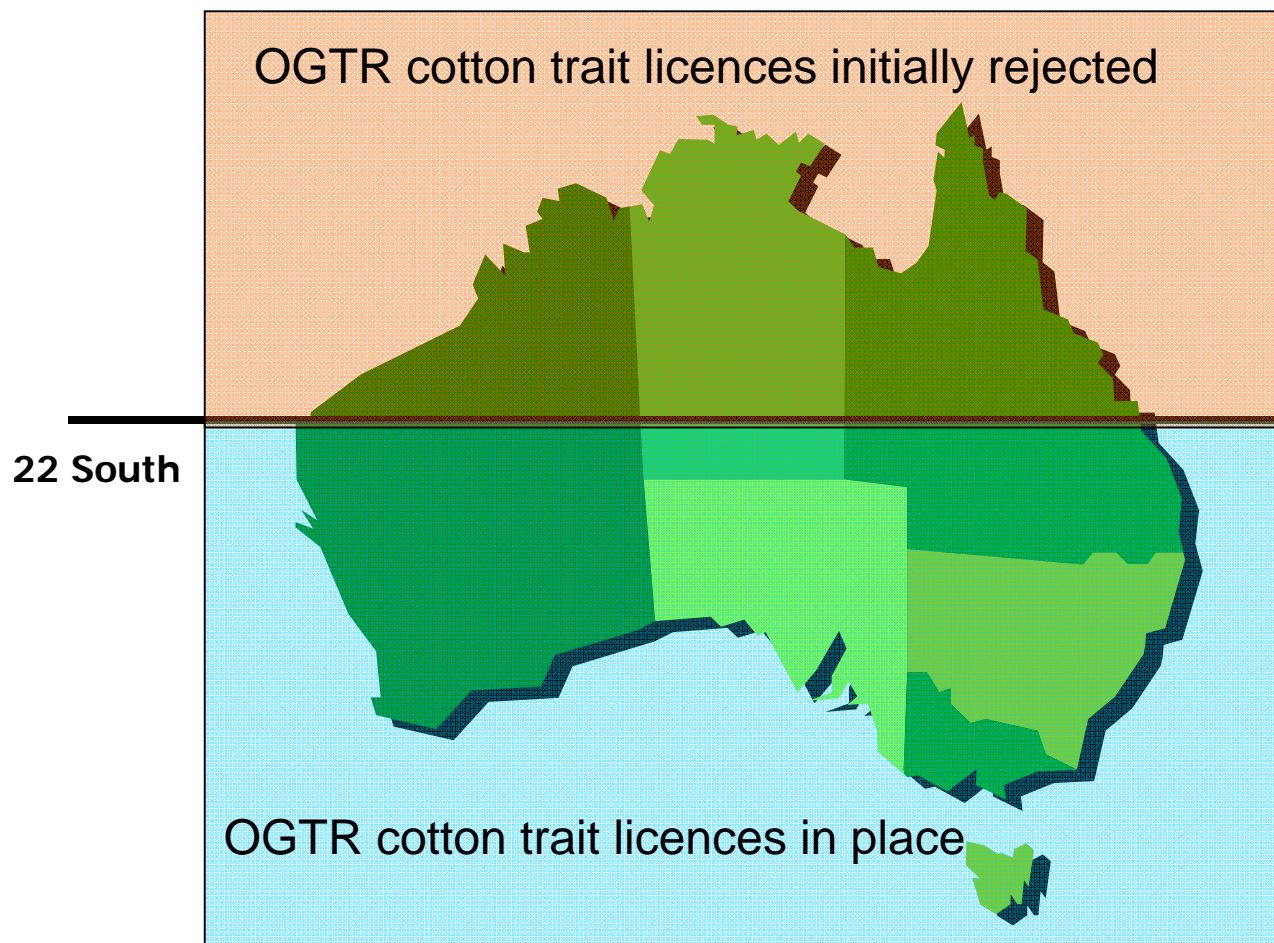
Gene Technology Regulator requirements

- **Weediness concerns**

- can GM cotton outcross with native cottons?
- can GM cotton become a weed?

Resistance management

- narrow planting window
- refuge crops
- suicide crops

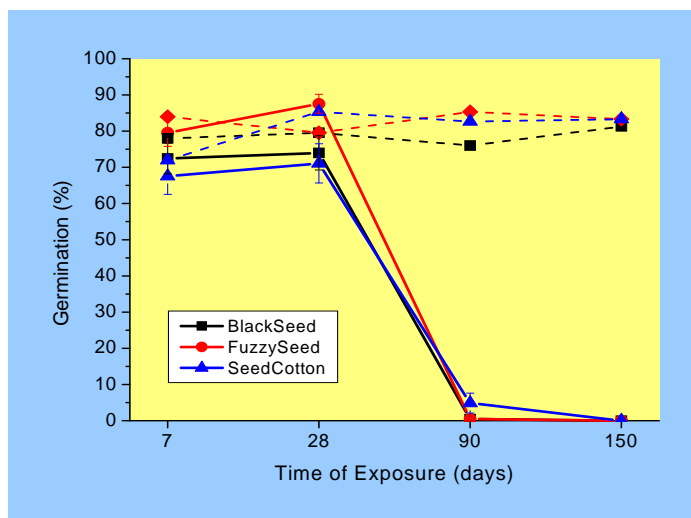


Two major studies required:

- can GM cotton outcross with the 17 native cottons?
- can GM cotton be an environmental weed? (5 year multi-site study)



1. “the probability that wild species could serve as recipients of transgenes is functionally zero...” Brubaker, CSIRO
2. “GM traits in cotton did not confer weediness at any site...” Eastick & Hearnden 2006, CSIRO





SCHEDULE A - Resistance Management Plan for Bollgard II® Cotton 2010/2011

Ord River Irrigation and Burdekin Bowen Basin Areas

Developed by Monsanto Australia Limited and the Transgenic and Insect Management Strategy (TIMS) Committee of Cotton Australia Limited.

The resistance management plan is based on three basic principles: (1) minimising the exposure of *Helicoverpa* spp. to the *Bacillus thuringiensis* (Bt) proteins Cry 1Ac and Cry 2Ab; (2) providing a population of susceptible individuals that can mate with any resistant individuals, hence diluting any potential resistance; and (3) removing resistant individuals at the end of the cotton season. The three principles are supported through the implementation of 5 elements that are the key components of the Resistance Management Plan. These elements are:

1. Refuge crops
2. Planting window
3. Pupae busting/Trap crops
4. Control of volunteers and ratoon cotton and
5. Spray limitations

The launch of NORpak

NORpak Ord River Irrigation Area

Cotton production and management guidelines for
the Ord River Irrigation Area (ORIA)
2006

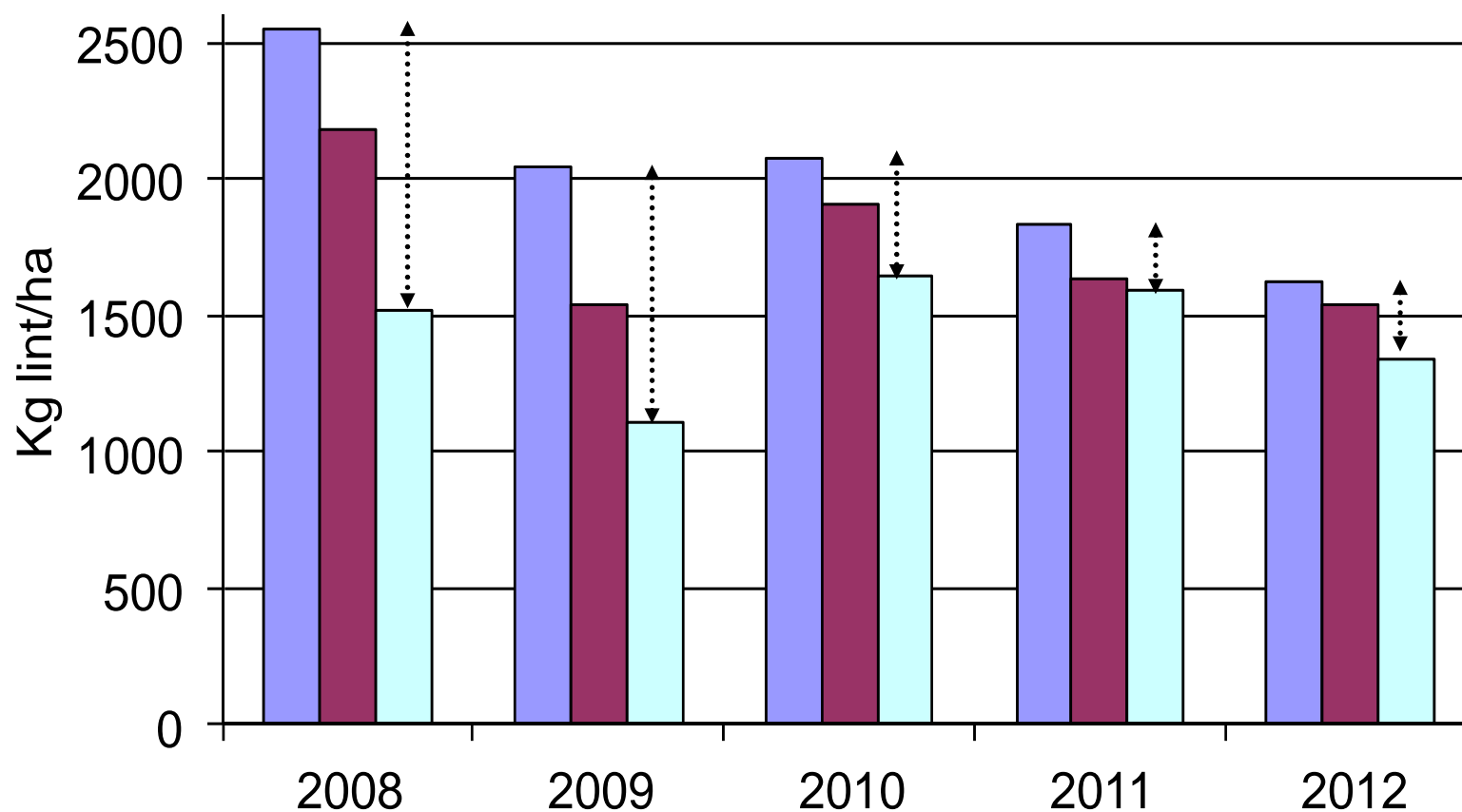
Compiled by
Stephen Yeates, Geoff Strickland, John Moulden and Andrew Davies





Closing the yield gap – Burdekin (Yeates)

■ Climate Study Yield ■ Top Farm Average ■ Commercial BRIA Crop Average





- **transferring southern practices to the north fails!**
- **commercial cotton production packages available as NORpak**
- **winter production systems test farmed for Kimberley & NT**
- **Gene Technology Regulator approvals granted- licence to operate**
- **on-farm research closes the “yield gap”**





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Questions??

