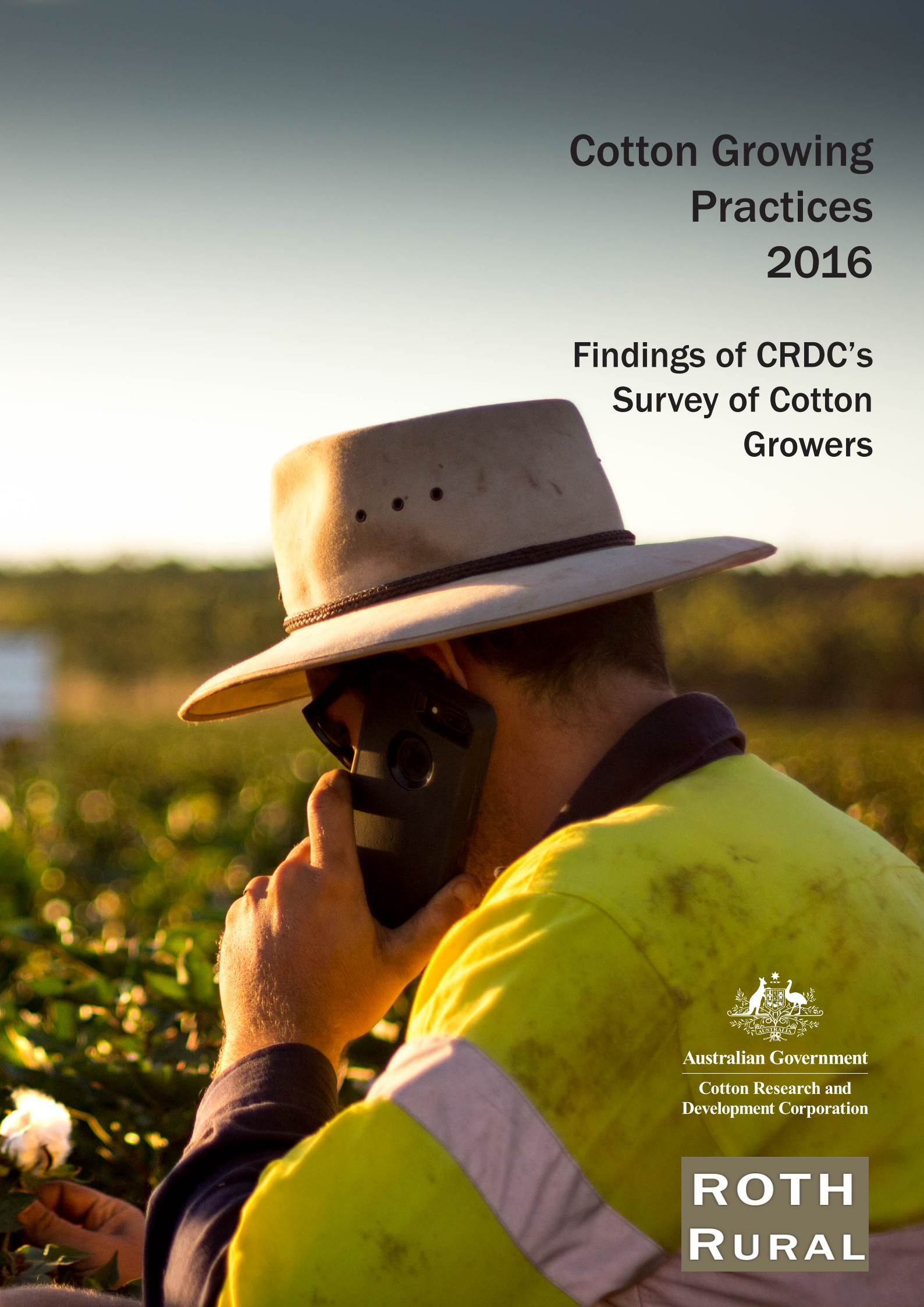
Cotton Growing Practices 2016

Findings of CRDC's Survey of Cotton Growers



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Cotton Research and Development Corporation

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Contents

Data presentation

For this report St George, Dirranbandi and Border Rivers regions have been aggregated as 'Macintyre–Balonne' and the Gwydir and Lower and Upper Namoi regions are combined as 'Northern NSW' where appropriate.

Unless otherwise defined, graphs indicate the proportion of respondents giving each response.

Acknowledgements

Our sincere thanks to the cotton growers who have shared information about their farming practices through this survey.

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The work was funded by the CRDC.

Summary

The Cotton Growing Practices 2016 survey was conducted in Spring 2016. It gathered information on farming practices and views of cotton growers about the 2015-16 season on the issues of nutrition, plant growth regulation, farm hygiene, chemical application management, harvesting, solar energy, CottonInfo and participation in research trials. This information is collated and analysed as an industry data set to help inform cotton research and industry policy and provide information for cotton growers about management practices across their industry.

Survey responses were received from 176 growers, representing 35% of the irrigated and 15% of the dryland 2015-16 crop area.

Findings include:

2015-16 cotton – a year of limited water with a long, hot, dry finish

- Average cotton yield was 12.4 bales/ha for irrigated cotton, 6.4 bales/ha for partially irrigated and 3.6 bales/ha for dryland.
- The highest yields reported from individual fields were 17.9 bales/ha on irrigated, 13 bales/ha on partially irrigated and 11.7 bales/ha on dryland cotton.
- Quality discounts were received on 35% of irrigated cotton farms (average $25.10, range $0.18 to $130), 44% of partially irrigated (average $14.90, range $2 to $40) and 64% of dryland (average $31.60, range $0.50 to $110).
- Colour, length and leaf were the most common causes of quality downgrades.
- Quality premiums were received on 28% of irrigated farms (average $2.10, range $0.03 to $10), 20% of partially irrigated (average $3.90, range $1.30 to $10) and 3% of dryland (average $1.27).
- Limitations to yield were reported due to:
    - Verticillium wilt - 23% of farms, average 26% estimated yield loss
    - Black Root Rot - 13% of farms, average 31% estimated yield loss
    - Fusarium Wilt - 14% of farms, average 32% estimated yield loss
    - Sclerotinia - 3% of farms, average 5.5% estimated yield loss
    - Boll Rot - 11% of farms, average 13% estimated yield loss
    - Herbicide spray drift - 30% of farms, average 19% estimated yield loss
    - Hail - 22% of farms, average 33% estimated yield loss
    - Reniform nematodes, pre-applied herbicide, fertiliser burn, waterlogging, sand blasting, drought and the hot and dry finish were also reported to have limited yields.
- Whole farm irrigation water usage was on average 8 ML/ha on fully irrigated and 3 ML/ha on partially irrigated, giving a calculated average irrigation water use efficiency of 1.8 bales/ML on irrigated and 2.7 bales/ML on partially irrigated cotton.

Cotton nutrition

- Average rates of applied nutrients per ha were:
    - Irrigated cotton: 284 kg N, 35 kg P, 34 kg K, 3 kg Zn, 18 kg S
    - Partially irrigated: 126 kg N, 39 kg P, 30 kg K, 4 kg Zn, 23 kg S
    - Dryland cotton: 78 kg N, 13 kg P, 14 kg K, 2 kg Zn, 8 kg S.
- The range in fertiliser application rates was large and not strongly correlated with yield.
- Changes in fertiliser application rates over 20 years of cotton production are presented.
- Nitrogen Fertiliser Use Efficiency was in the 'optimum' range for 11% of irrigators and 26% of dryland.
- Soil tests are the most used analysis for determining fertiliser rates (soil surface tests were used by 85% of irrigators and 96% of dryland, soil tests below 30 cm were used on 68% of irrigated and 85% of dryland respondents), followed by petiole tests (44% irrigated and 15% dryland).
- 44% of respondents varied fertiliser rates based on soil testing.
- 46% of irrigated respondents reported fertiliser costs between $400 and $600/ha.
- 53% of dryland respondents reported fertiliser costs below $100/ha.
- The most used methods for applying nitrogen fertiliser were gas and granular pre-season and water-run or top dressed in season.
- 53% of respondents used manures (including chicken, cattle, pig, biosolids) or composts in their cotton nutrition program with the highest usage being in the Darling Downs and Southern regions.
- 67% of respondents believed they had adequate information to calculate nitrogen use efficiency and 73% believe they had a good understanding of maximising nitrogen use efficiency. 40% indicated they understood how to reduce nitrous oxide emissions and 54% were confident in the use of seasonal forecasting information to aid decisions.
- 73% of respondents believed more than 50% of applied nitrogen fertiliser goes into the crop, 19% believed more than 70% goes to the crop.

Plant growth regulators

- 51% of respondents used plant growth regulators early season.
- 73% used plant growth regulators at cut-out.

Chemical application management

- Over 60% of respondents recalled hearing about spray drift management through radio, CottonMatters or from another grower or agronomist in the 2015-16 season.
- Recall of communications about spray drift was highest in the Macintyre - Balonne region.
- 85-90% of respondents were confident in their knowledge, understanding and staffing flexibility for spray application management. 92% indicated they had a thorough understanding of surface temperature inversions and their impact on chemical sprays.
- 59% believed weather monitoring systems were not accurate enough to determine the inversion risks. Several suggestions have been made in relation to this.
- The tools considered most useful for reducing off-target chemical drift were weather monitoring (both information services and on-board tools and alerts) and CottonMap.
- Suggested improvements to CottonMap and BeeConnected related to raising awareness, increasing participation, ease of use and improvements to the systems.
- Suggestions for the industry to manage risks of chemical damage included weather monitoring and risk alerts, changing industry practice and culture, compliance and regulation, technology, information, education, information about bees and working with non-cotton growers.

Harvesting

- The 2016 harvest window stretched from February to July with over 70% of farms harvesting in April.
- 57% of the harvest was done by growers using their own machinery, 41% by contractors.
- Round module harvesters were used on 67% of respondent farms in 2016, harvesting 81% of the crop.
- 78% used a harvest groundspeed between 3.6 and 4 miles per hour.
- 69% reported breakage issues with plastic module wrap.
- 53% use a handheld moisture meter prior to and/or during harvest. 77% tolerate no more than 12.5% moisture during harvest. 19% don't measure moisture.
- 77% use flatbed trucks to transport cotton to gins.
- 50% use the RFID tag information.

Solar energy

- 37% of respondents had solar energy installations.
- Household and shed power are the most common uses of this solar energy.
- The most common barriers to investment in solar energy for irrigation pumping were uncertainty about feasibility, low priority and cost (including waiting for cheaper batteries).
- The majority of respondents had an understanding of weather and climate models and information but did not understand carbon dynamics or the emissions reduction fund.

Climate and carbon

- 90% of respondents understood El Nino southern oscillation effect on local rainfall and temperature, 91% understood sourcing of local climate information.
- 60-70 % did not understand carbon sequestration in the farming system or native vegetation.
- 91% did not understand the emissions reduction fund or how to participate.

CottonInfo and research

- 80% of respondents receive information and/or contact from the CottonInfo team, ranging from 93% in Central Queensland to 69% on the Darling Downs.
- 85% source CottonInfo information frequently or occasionally.
- 35% had hosted cotton industry research trials last season, 42% of these known to be CRDC funded.
- 43% recalled at least one of the carbon farming project webinars, fact sheets or other extension tools.

Telecommunication services

- 99% of respondents had the internet connected.
- 56% could access the internet on all or most of the farm.
- 1% had no mobile phone coverage on their farm, 17% have it on small areas of the farm only.
- 68% of respondents indicated that internet speed, download limits, cost and/or reliability cause major limitations or completely prevent the use of internet tools for business.
- Some farms had moved their office operations into town to overcome telecommunications limitations on farm, and number of other limitations and strategies are described.

Background

From 2013 to 2016 the Cotton Research and Development Corporation (CRDC) commissioned Roth Rural to undertake regular surveys of cotton growers to gather information about farming practices and growers' views on research, development and extension. This information helps CRDC measure the benefits of the research it invests in. Information gathered through these and earlier surveys in 2011, 2008, 2007, 2006, 2000 and 1997 allow the industry to track changes in farming practice over time. Each of those surveys focused on specific aspects of the farming system.

This final survey, conducted in September 2016, focussed on nutrition, plant growth regulation, farm hygiene and disease, chemical application management, harvesting, solar energy, climate and carbon, CottonInfo and grower participation in CRDC research trials.

Survey design & distribution

The survey was developed together with CRDC, Cotton Australia and researchers, with reference to the CRDC Monitoring & Evaluation Framework and pilot tested with cotton growers. It was distributed both electronically and on paper:

- Postal mail-out to all growers registered with CRDC (894 farms*)
- CRDC email to all growers with email addresses registered with CRDC (585 farms)
- Invitations in Cotton Australia's CottonMatters Newsletter
- Paper distribution at some industry meeting/s.
- Follow up phone calls and email to encourage response.

*The total population pool was adjusted to 837 after removing contacts that were returned to sender, did not grow cotton, had not grown recently or were duplicate contacts for a farm.

Survey response

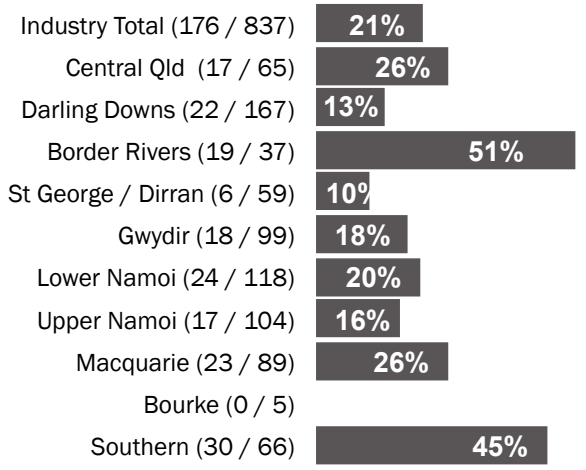
The survey distribution in early September 2016 during a very wet period saw a strong initial response. The seasonal conditions resulted an intensely busy summer crop planting and winter crop harvest period which was challenging for later survey response.

176 growers responded giving a response rate of:

- 21% of the 837 farms registered with CRDC
- 30% of the 585 farms with email addresses registered with CRDC
- 35% of the area of irrigated cotton for 2015-16
- 15% of dryland cotton crop for 2015-16.

Of those growers who responded, 81% grew cotton this season (2015-16).

Response rate by number of farms
(Brackets give response number / number of farms registered with CRDC)



Response rate by area of 2015-16 cotton

	Area in survey Field hectares		% of total industry cotton area*
IRRIGATED COTTON	Irrigated	Partially Irrigated	
Industry Total	**62,844**	**9,282**	**35%**
Central Queensland	5,342	600	32%
Darling Downs	5,447	670	21%
Macintyre - Balonne	15,175	331	40%
Northern NSW	14,095	7,051	39%
Macquarie	4,075	630	49%
Southern NSW	18,710	0	35%
DRYLAND COTTON			
Industry Total	**13,535**		**15%**
Central Queensland	200		67%
Darling Downs	3,140		15%
Macintyre - Balonne	1,025		38%
Northern NSW	9,042		14%
Macquarie	128		7%
Southern NSW	0		-

* Compared with industry total reported in the Cotton Yearbook. Field hectares were calculated using a 1.5 conversion from green hectares where required.

Findings

2015-16 Season results

The 2015-16 cotton season was typified by limited water with a long, hot, dry finish to the season. This survey included a category for 'partially irrigated cotton' (up to 3 irrigations) as partial irrigation was used as a strategy in several regions as a response to limited irrigation water. Unless otherwise defined, graphs indicate the proportion of respondents giving each response.

Cotton in the farming system

Please list the details of your cotton crop from last season

Please list the total area of land (ha) on your farm developed

Respondents:
120 irrigated
93 dryland

Land developed for irrigation and dryland cropping on farms of survey respondents

	IRRIGATION	DRYLAND CROPPING
Average land area developed (on those farms with irrigation / dryland)	1,737 ha	2,546 ha
Range	97 – 13,200 ha	50 – 60,000 ha
Proportion of developed area planted to cotton in 2015-16 (on those farms with cotton in 2015-16)	35 %	6 %

Cotton yields 2015-16

Please list the details of your cotton crop from last season:

Target Yield
Average yield
Highest yield from one field

Respondents:
113 Irrigated
24 Partially irrigated
33 Dryland

	Number of farms reported	Whole farm yield (Bales/ha) Average	Minimum	Maximum	Highest yielding field
IRRIGATED					
All regions	113	**12.4**	**3.7**	**15.7**	**17.9**
Central Qld	13	8.6	3.7	11.0	14.1
Darling Downs	12	12.1	6.0	14.0	15.9
Macintyre - Balonne	18	13.4	6.4	10.0	16.8
Northern NSW	33	12.8	9.8	15.0	16.0
Macquarie	10	14.4	13.0	15.7	17.5
Southern NSW	27	12.7	10.5	14.8	17.9
PARTIALLY IRRIGATED					
All regions	24	**6.4**	**0.8**	**10.0**	**13.0**
Central Qld	1	10.0	10.0	10.0	13.0
Darling Downs	3	6.9	5.0	9.3	9.3
Macintyre - Balonne	3	8.0	6.4	10.0	10.0
Northern NSW	13	8.0	0.8	1.5	12.0
Macquarie	2	5.9	5.0	5.9	5.9
DRYLAND					
All regions	33	**3.6**	**0.8**	**9.0**	**11.7**
Central Qld	1	1.5	1.5	1.5	2.0
Darling Downs	9	5.8	4.0	9.0	11.7
Macintyre - Balonne	3	4.0	2.2	6.6	7.1
Northern NSW	19	2.7	0.8	4.5	6.5
Macquarie	1	2.0	2.0	2.0	2.5

No partially irrigated or dryland cotton was reported in the Southern region

Quality discounts and premiums received on 2015-16 cotton

Please list the details of your cotton crop from last season

Respondents:
113 Irrigated
24 Partially irrigated
33 Dryland

	Quality discounts Farm average $/bale				Quality premiums Farm average $/bale			
	% farms	Average*	Min.	Max.	% farms	Average*	Min.	Max.
Irrigated								
All regions	**35%**	**25.10**	**0.18**	**130.00**	**28%**	**2.10**	**0.03**	**10.00**
Central Qld	71%	39.71	5.00	92.12	0%			
Darling Downs	18%	5.50	5.00	6.00	36%	2.44	1.50	4.00
Macintyre - Balonne	44%	16.10	1.80	40.00	39%	3.38	1.78	10.00
Northern NSW	14%	13.80	1.00	30.00	33%	1.41	0.03	3.00
Macquarie	40%	44.00	5.00	130.00	30%	2.50	1.00	5.00
Southern NSW	44%	20.68	0.18	80.00	26%	1.67	1.00	2.50
Partially Irrigated								
All regions ^	**44%**	**14.90**	**2.00**	**40.00**	**20%**	**3.90**	**1.30**	**10.00**
Darling Downs	25%	6.00	6.00	6.00	0%			
Macintyre - Balonne	33%	10.00	10.00	10.00	100%	5.45	2.00	10.00
Northern NSW	60%	16.44	2.00	40.00	13%	1.60	1.30	1.89
Dryland								
All regions ^	**64%**	**31.60**	**0.50**	**110.00**	**3%**	**1.27**	**1.27**	**1.27**
Darling Downs	70%	7.10	0.50	20.00	0%			
Macintyre - Balonne	0%				33%	1.27	1.27	1.27
Northern NSW	76%	42.30	3.00	110.00	0%			

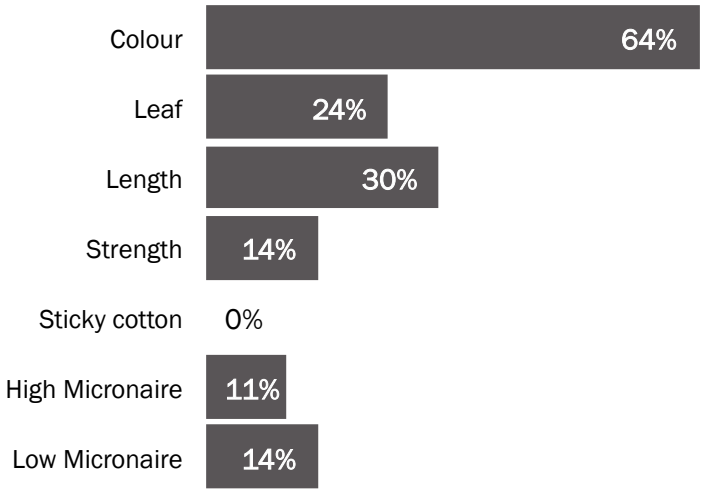
* Average value from those farms that recorded a discount or premium, excludes 0 values
^ The very small number of partially irrigated and dryland fields from Central Queensland and the Macquarie did not record any quality discounts or premiums

Type of quality discounts 2015-16

Which quality discounts (if any) were the most costly for you last season?

76 respondents

% of those farms that had recorded a quality discount



Irrigation applied 2015-16

Please list the details of your cotton crop from last season:

Irrigation volume used for cotton / ha
Average yield

Respondents:
113 Irrigated
24 Partially irrigated

	IRRIGATED		PARTIALLY IRRIGATED	
	Irrigation Volume ML/ha	Calculated Irrigation Efficiency Bales/ML	Irrigation Volume ML/ha	Calculated Irrigation Efficiency Bales/ML
All regions	**8.0**	**1.8**	**3.0**	**2.7**
Central Qld	7.2	1.3	2.0	5.0
Darling Downs	4.6	3.2	1.7	5.9
Macintyre - Balonne	8.4	2.2	5.0	2.0
Northern NSW	7.2	1.8	2.9	2.3
Macquarie	8.9	1.6	2.5	2.2
Southern NSW	10.0	1.3		

Limitations to yield

Yield losses to disease, herbicide, hail and other factors 2015-16 cotton

Please list any area (hectares) of cotton affected by the following last season and an approximate estimate of the % yield loss caused.

107 respondents

	% farms affected	Average area affected (ha)	Maximum area affected (ha)	Average estimated yield loss (% yield reduction)	Maximum yield loss (%)
Verticillium Wilt	23 %	176	503	26 %	100 %
Black Root Rot	13 %	122	450	31 %	100 %
Fusarium	14 %	28	87	32 %	100 %
Sclerotinia	3 %	267	300	5 %	10 %
Boll Rot	11%	303	595	13 %	30 %
Herbicide spray drift	30 %	318	4300	19 %	100 %
Hail	22 %	168	600	33 %	100 %

Other Impacts on Yield Reported by Growers	Hectares Affected	Yield Loss (%)
Reniform Nematodes	200	20
Pre applied herbicide	70	20
Fertilizer burn	35	
Waterlogging	250	30
Sand blasted	622	0
Drought	345	100
Severe drought		90
Dry finish		
Hot and dry finish	450	

Comments about yield loss and impacts

Verticillium Wilt

Ruthless
Severe and getting worse
Difficult to estimate yield loss
Visually it seemed incidence was high but yield loss not measurable
Least damage for many years
Very serious issue
Not noticeable

Black Root Rot

Difficult to estimate yield loss
Implemented fungicide regime which seemed to reduce incidence

Fusarium

Grow only 75BRF
Small areas
Two small areas
Small patches insignificant towards yield

Herbicide spray drift

Everything got hit early but no yield penalty this year
Severely affected 75ha-35% loss
All from inversion conditions
Could see leaves deformed, didn't affect yield
Multiple inversion hits over summer
Field taken out
Difficult to estimate yield loss
Minor yield losses
Hard to know with only one field however it was hit twice
Very hard to determine yield loss.
Three separate lots of 2,4D touched down
Slight damage, no yield penalty
Hard to determine yield loss

Hail

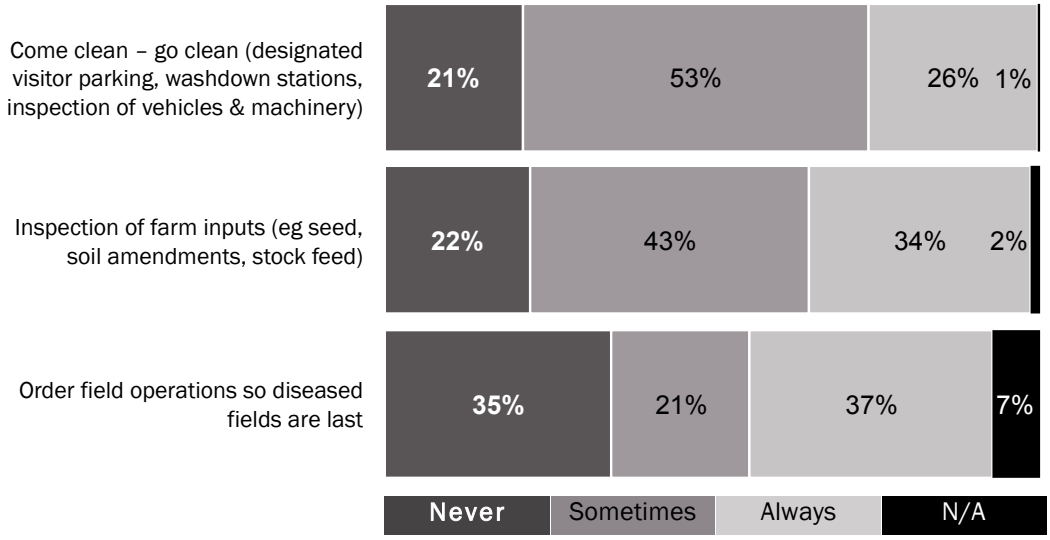
Total wipe out
Due to hot finish we were able to grow crop out, maximising yield potential
102 ha replanted
Very early hail
Replanted

Farm hygiene and disease monitoring

Frequency of use of farm hygiene practices

How regularly do you use the following to minimise entry or spread of weeds and diseases on your farm

176 respondents

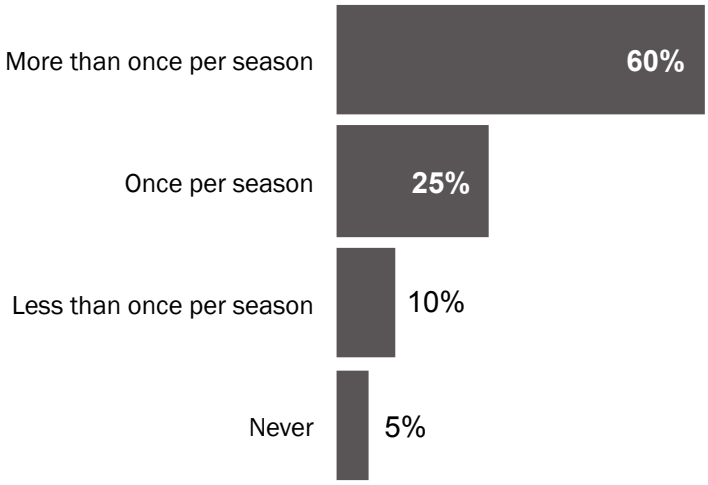


79% of respondents use come clean – go clean farm hygiene sometimes or always
77% inspect farm inputs at least sometimes.
85% monitor for disease at least once per season.

Frequency of monitoring for disease presence, distribution and severity

How often do you do a survey or otherwise monitor for the presence, distribution and severity of diseases on your farm?

176 respondents



Rates and form of fertiliser applied nutrients to 2015-16

Please list the rate of applied nutrients for your most typical irrigated, partially irrigated and/or dryland cotton field/s in 2015-16. Nutrient rate not fertiliser rate - If you prefer to enter the fertiliser products and rate please leave this questions blank and use the next table below instead.

Respondents:
99 Irrigated
14 Partially irrigated
22 Dryland

Note:
Zero values are excluded from calculations – each average is the average for those farms using this type of application.

Excludes nutrient applied in manures and composts.

IRRIGATED COTTON n = 99		Avg.	Min	Max	% Farms
Preseason nitrogen – solid fertiliser	(kg N/ha)	139	2	300	66%
Preseason nitrogen – gas fertiliser	(kg N/ha)	193	100	270	41%
Preseason nitrogen – liquid	(kg N/ha)	33	3	80	4%
In season nitrogen – solid fertiliser	(kg N/ha)	113	30	300	43%
In season nitrogen – gas fertiliser	(kg N/ha)	95	10	180	10%
In season nitrogen – liquid fertiliser	(kg N/ha)	62	1	140	9%
In season nitrogen – water applied	(kg N/ha)	90	14	220	46%
Total applied Nitrogen	(kg N/ha)	275	18	519	100%
Preseason phosphorus – fertiliser	(kg P/ha)	35	20	100	36%
In season phosphorus – fertiliser	(kg P/ha)	17	4	50	7%
Total applied Phosphorus	(kg P/ha)	35	0.7	200	82%
Preseason potassium – fertiliser	(kg K/ha)	34	0.15	100	45%
In season potassium – fertiliser	(kg K/ha)	19	0.4	50	7%
Total applied Potassium	(kg K/ha)	34	0.15	100	51%
Zinc fertiliser	(kg Zn/ha)	3	0.03	33	73%
Sulphur	(kg S/ha)	18	0.1	200	38%
Trace elements	(kg/ha)	2	2	2	1%

PARTIALLY IRRIGATED COTTON n = 14		Avg.	Min	Max	% Farms
Preseason nitrogen – solid fertiliser	(kg N/ha)	130	100	150	21%
Preseason nitrogen – gas fertiliser	(kg N/ha)	112	80	200	43%
Preseason nitrogen – liquid	(kg N/ha)	80	80	80	7%
In season nitrogen – solid fertiliser	(kg N/ha)	76	14	125	36%
In season nitrogen – gas fertiliser	(kg N/ha)	150	150	150	7%
In season nitrogen – liquid fertiliser	(kg N/ha)	60	60	60	7%
In season nitrogen – water applied	(kg N/ha)	20	20	20	14%
Total applied Nitrogen	(kg N/ha)	126	14	250	100%
Preseason phosphorus – fertiliser	(kg P/ha)	39	20	100	36%
In season phosphorus – fertiliser	(kg P/ha)	-	-	-	-
Total applied Phosphorus	(kg P/ha)	39	20	100	36%
Preseason potassium – fertiliser	(kg K/ha)	30	20	50	29%
In season potassium – fertiliser	(kg K/ha)	-	-	-	-
Total applied Potassium	(kg K/ha)	30	20	50	29%
Zinc fertiliser	(kg Zn/ha)	4	2	8	29%
Sulphur	(kg S/ha)	23	20	30	21%
Trace elements	(kg/ha)	-	-	-	-

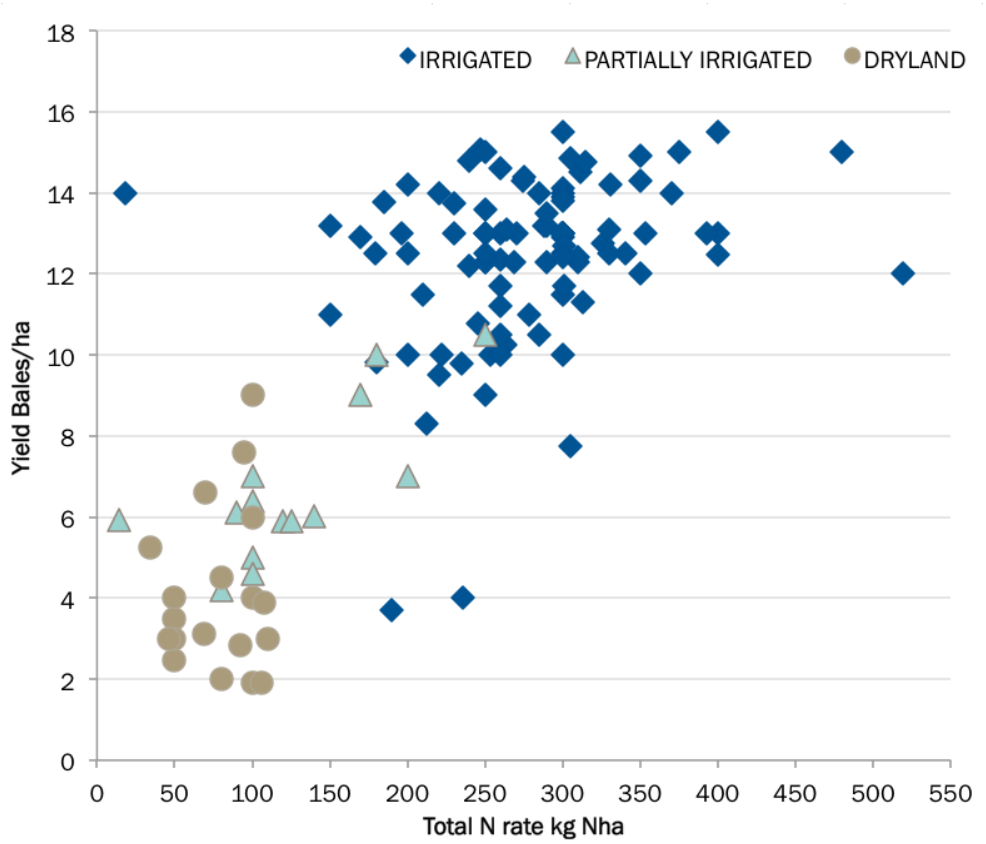
DRYLAND COTTON n = 22		Avg.	Min	Max	% Farms
Preseason nitrogen – solid fertiliser	(kg N/ha)	81	46	120	55%
Preseason nitrogen – gas fertiliser	(kg N/ha)	68	34	110	27%
Preseason nitrogen – liquid	(kg N/ha)	3	3	3	5%
In season nitrogen – solid fertiliser	(kg N/ha)	62	46	100	18%
In season nitrogen – gas fertiliser	(kg N/ha)	80	80	80	5%
In season nitrogen – liquid fertiliser	(kg N/ha)	6	6	6	5%
In season nitrogen – water applied	(kg N/ha)	-	-	-	-
Total applied Nitrogen	(kg N/ha)	78	3	120	100%
Preseason phosphorus – fertiliser	(kg P/ha)	15	5	50	50%
In season phosphorus – fertiliser	(kg P/ha)	7	4	8	14%
Total applied Phosphorus	(kg P/ha)	13	4	50	64%
Preseason potassium – fertiliser	(kg K/ha)	15	2.5	30	27%
In season potassium – fertiliser	(kg K/ha)	6	6	6	5%
Total applied Potassium	(kg K/ha)	14	2.5	30	32%
Zinc fertiliser	(kg Zn/ha)	2	0.15	8	64%
Sulphur	(kg S/ha)	8	1.6	15	32%
Trace elements	(kg/ha)	0.5	0.5	0.5	5%

Change in rates of fertiliser applied to cotton over the past 20 years

FERTILISER #	1997*	2001*	2006*	2007*	2011^ Irrigated	2013+ Irrigated	2016 Irrigated	2011^ Dryland	2013+ Dryland	2016 Dryland
Pre season nitrogen - solid fertiliser (kg N/ha)		80	87	101	142	135	139	89	89	81
Pre season nitrogen - gas fertiliser (kg N/ha)		78	71	60	155	169	193	84	70	68
Pre season nitrogen - liquid fertiliser (kg N/ha)							33			3
In season nitrogen – solid fertiliser (kg N/ha)		17	29	60	99	100	113	45	33	62
In season nitrogen – gas fertiliser (kg N/ha)		8	14	18	83	88	95	40	-	80
In season nitrogen - liquid fertiliser (kg N/ha)							62			6
In season N water applied (kgN/ha)					57	61	90	5	-	-
TOTAL applied N kg/ha	125	176			217	243	275	96	84	78
Pre season phosphorus fertiliser (kg P/ha)		23	30	35	42	31	35	14	14	15
In season phosphorus fertiliser (kg P/ha)		2	3	2	20	15	17	13	8	7
TOTAL applied P kg/ha					40	31	35	16	13	13
Pre season potassium fertiliser (kg K/ha)		8	16	24	33	26	34	7	10	15
In season potassium fertiliser (kg K/ha)		0	2	4	15	12	19	2	-	6
TOTAL applied K kg/ha					28	24	34	7	10	14
Zinc fertiliser (kg Zn/ha)		5	5	5	4.4	3	3	3.7	1.8	2
Sulphur (kg S/ha)					6.3	14	18	2.4	5.5	8
Trace elements					21	9	2	4	-	0.5

Average rate across those farms who have recorded each type of fertiliser (excludes zero values)
* Roth G (2009) Economic, environmental and social sustainability indicators of the Australian cotton industry. Cotton CRC.
^ GHD Hassall (2011) Cotton Grower Practices Survey. Cotton CRC and CRDC.
+ Roth Rural (2013) Cotton Growing Practices Survey. CRDC.

Fertiliser rate vs yield



Note: The very low rate of nitrogen on irrigated cotton was from a farm that also applied biosolids.

Nitrogen fertiliser use efficiency

Calculated as kg lint/ha divided by applied kg N fertiliser/ha

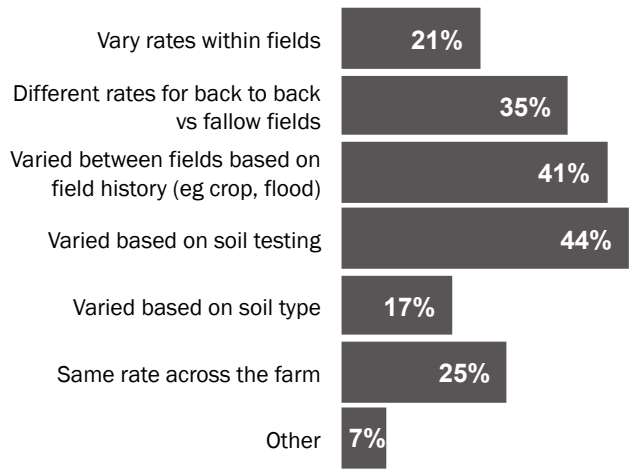
	IRRIGATED		DRYLAND	
	Average kg lint/kg N	% of farms in optimum range *	Average kg lint/kg N	% of farms in optimum range *
Central Qld	8.0	0 %	-	-
Darling Downs	12.0	29 %	19.1	17 %
Macintyre-Balonne	10.9	7 %	15.8	0 %
Northern NSW	11.1	19 %	9.4	36 %
Macquarie	11.2	0 %	-	-
Southern NSW	9.9	5 %	-	-
All regions	**10.5**	**11 %**	**22.0**	**26 %**

* Optimum range of 12.5 to 16 kg lint/kg N fertiliser established by Dr Ian Rochester

Variations in fertiliser rates

Did you vary fertiliser application rates between different fields / management units last season?

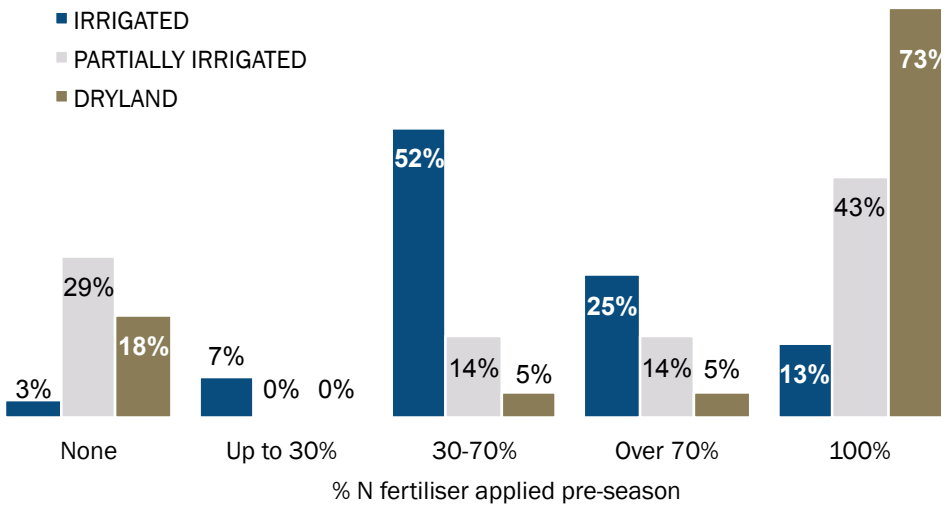
118 respondents



% N fertiliser applied pre-season

Proportion of growers – calculated from rates of applied N fertilisers.

Respondents
99 irrigated
14 partially irrigated
22 dryland



Proportion of N applied pre-season in 3 different seasons

	IRRIGATED	PARTIALLY IRRIGATED	DRYLAND
2015-16	63%	63%	80%
2012-13	68%		94%
2010-11	60%		

Timing and methods of nitrogen fertiliser application

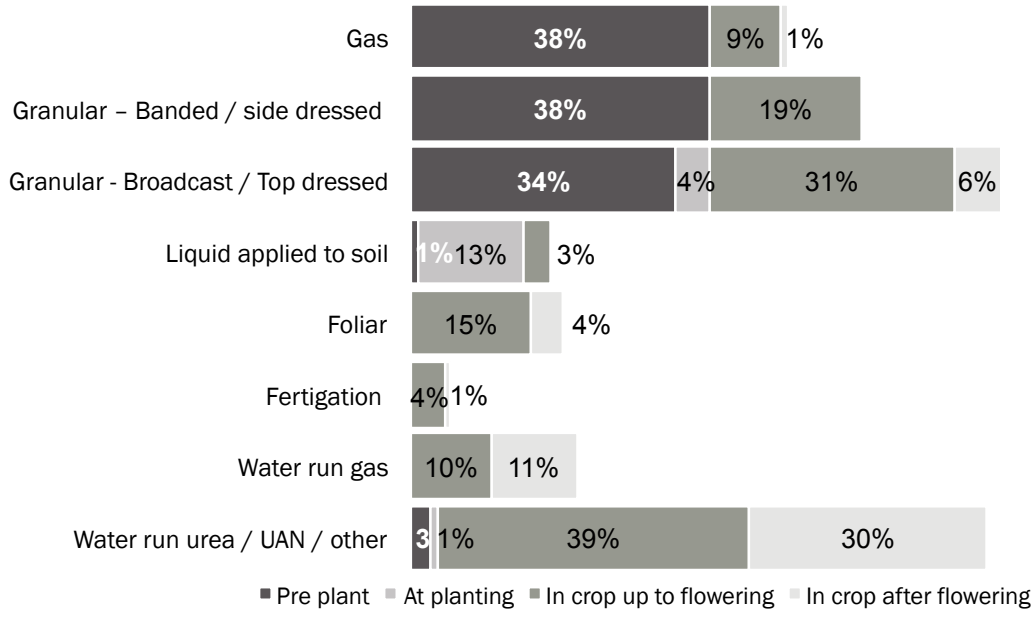
In your most typical cotton field, how and when did you apply NITROGEN fertiliser for cotton crops in 2015-16?

119 respondents

The majority of growers used a mix of methods and timing to apply nitrogen fertiliser.

Total proportion of growers using each application method at any stage of the season:

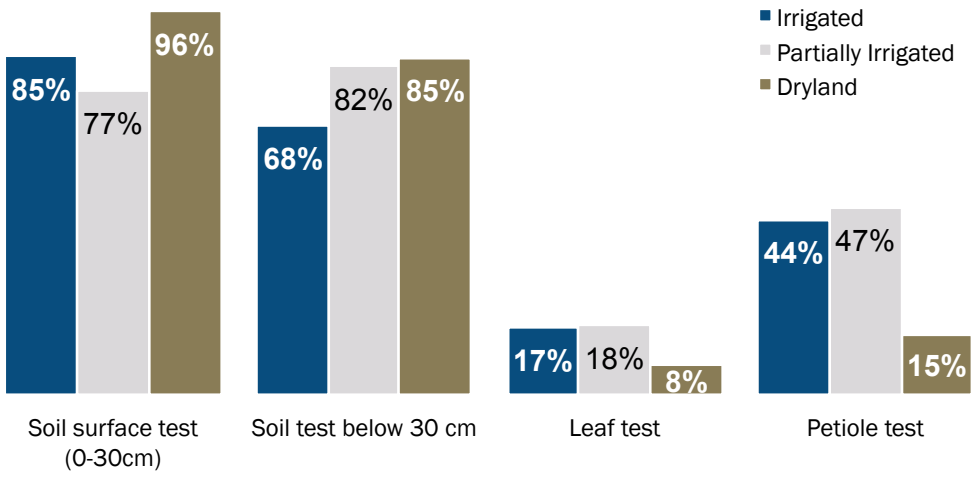
- 48% Gas
- 57% Granular – Banded / side dressed
- 75% Granular - Broadcast / Top dressed
- 18% Liquid applied to soil
- 19% Foliar
- 5% Fertigation (through lateral move, pivot, drip irrigation)
- 21% Water run gas
- 73% Water run urea / UAN / other



Analyses referred to in planning fertiliser rates

When deciding on fertiliser rates for your 2015-16 cotton crops, which of the following analyses did you refer to, if any, for each cotton system?

107 respondents

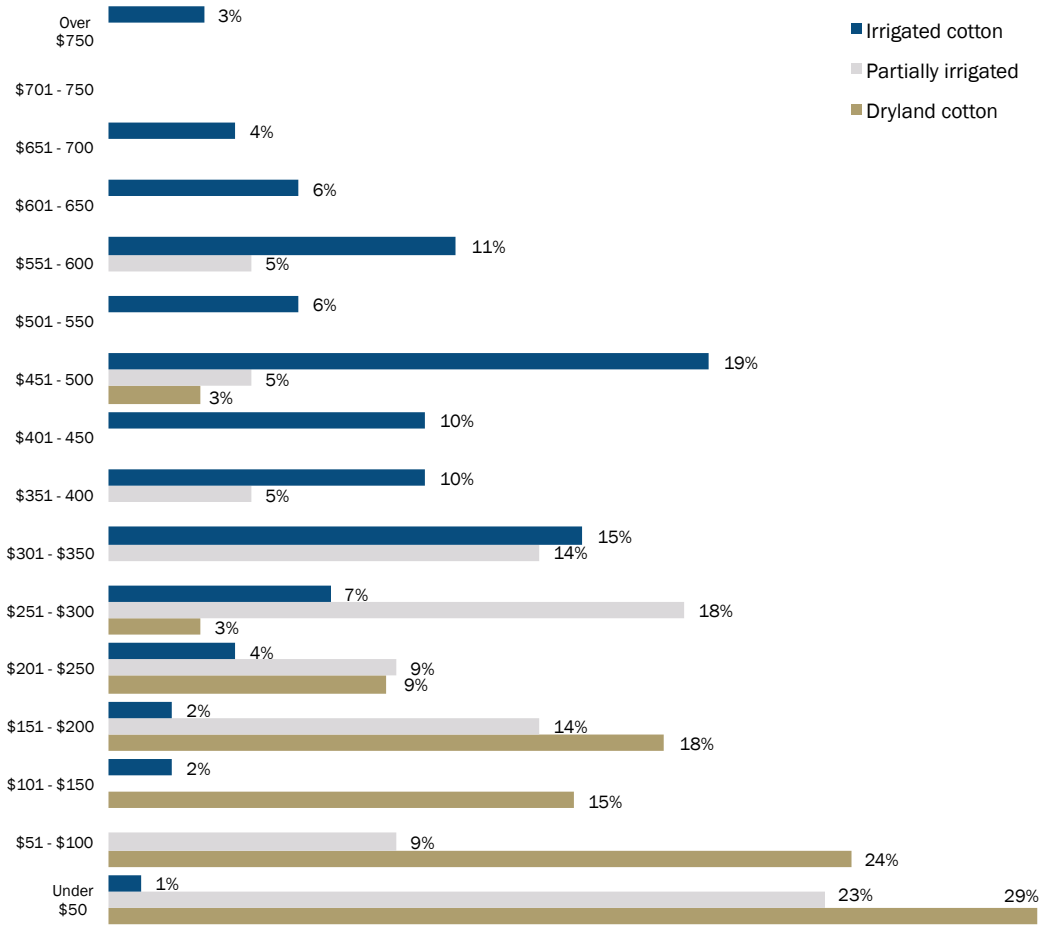


Cost of fertiliser inputs for cotton

What was the approximate cost per hectare of nutritional inputs for your 2015-16 cotton crops?

Please include product costs but exclude application costs and tick the cost bracket for each irrigated and/or dryland crops where relevant.

Respondents:
100 Irrigated
22 Partially irrigated
34 Dryland



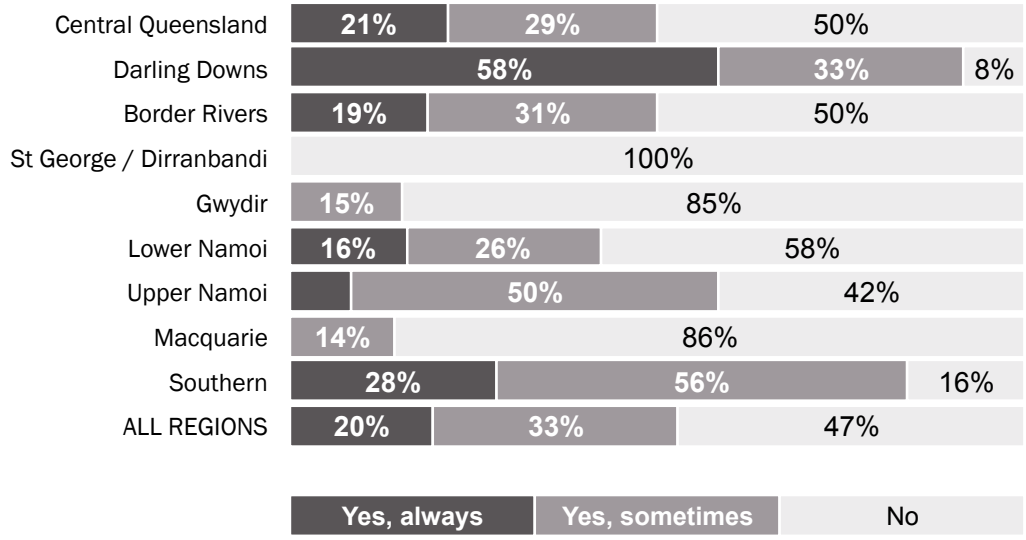
Use of manures and composts

Do you use manures or composts as part of your nutrition program?

123 respondents

53% of respondents used manure or composts for cotton nutrition.

The use of manures varied by region, likely due to proximity to sources such as feedlots and poultry sheds, etc. Manures and composts used included chicken manure, cow manure, feedlot manure, pig manure, composted cotton trash and biosolids.



Types and rates of manures and composts used on cotton

What type and what rates of manures and composts do you use?

53 respondents

Chook Manures at 2t/ha
Chicken Manure 2t/ha
Chicken manure
Chicken litter 1.5t/ha
Chook Manure
Chicken manure at around a ton / Ha
Chook 2t/ha
Chicken manure 10 m/ ha
We use Chicken Litter at normally 8 cubic meters /ha
1 t chook
Chicken litter - Variable rates
Chicken Litter at 5 t/ha
chook poo 3-5 m3/ha
Chicken manure 6m/ha
Chicken Litter - 10 cubic metres/ha or approx. 5 tonne/ha
Chicken litter at 2 t/Ha
Chook manure @3t /ha
composted chicken manure at 3.5 t/ha
Chook manure 3t/ha, Pig manure 2t/ha

Screened cow manure 5 to 6 tonnes per ha
Cow manure 10 tonne/ha
Cow manure @ 10t ha every 5 years
Screened cow manure 5t/ha
Cow, 10 ton to Ha
Cow manure 10tonnes/ha

Feedlot manure and or layer hen manure, 3-5 cubic
Composted feedlot manure 1 to 2 tonnes per hectare. Raw feedlot manure 5 to 10 tonne per hectare depending on use
10t/ha aged feedlot manure
Local feedlot manure at 8 tons / ha
Blood & bone / feedlot manure compost
Feedlot manure for 25 years at 5t/ha
Feedlot manure 10/20 t/ha
Feedlot 3 t/ha

Mix of pig, chicken and cow manures and lime.
Chook and Cow 5T/ha
Pig compost 2t/ha chicken manure 8 m3/ha
2 t/ha swine compost

2 T/Ha
4m3
Dryland 5-7 t/ha, Irrigated 7-15 t/ha
4t/ha
2tonne/hectare
10t/ha
10 tonne manure/ ha
5 t/ha

Composted gin trash 6t/ha
Cotton Compost - 5t/ha
Gin trash compost at 5t/ha
Cotton compost
Composted cotton trash at 7.5 t/ha per irrigated crop or Beef manure at same rate

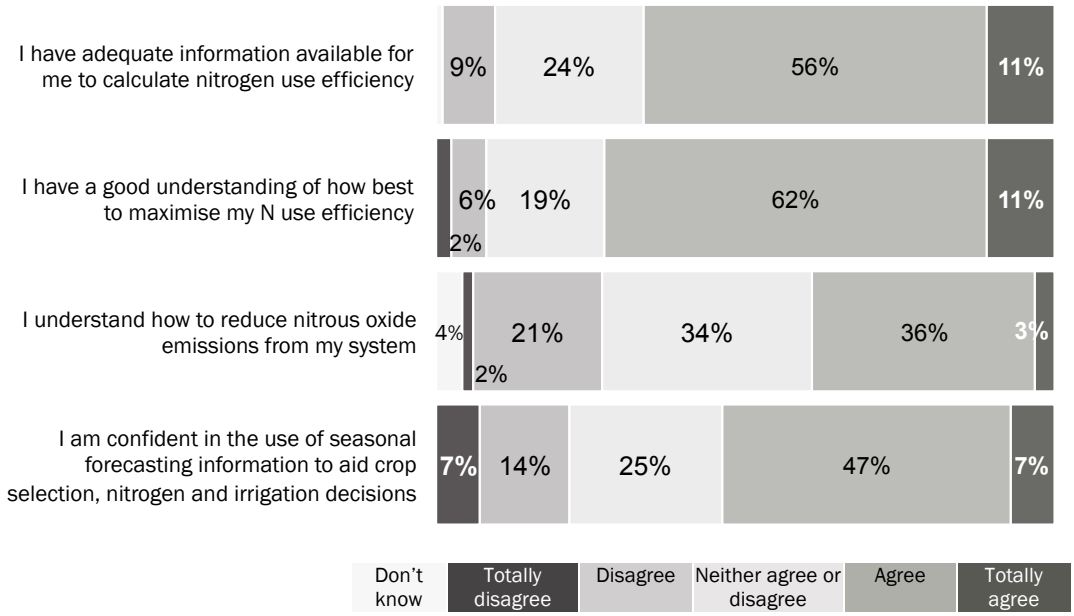
Biosolid 150 ton/ha every few years
Biosolids 20t/ha

Green manure vetch and oats

Knowledge of management for nitrogen efficiency

Please indicate your agreement with each of these statements.

126 respondents

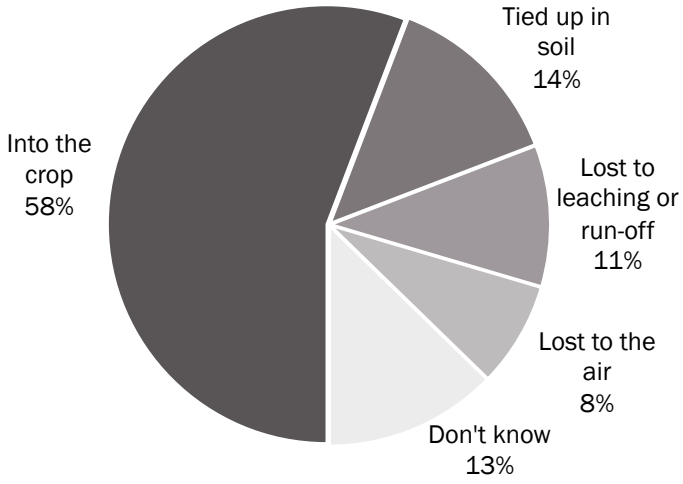


Nitrogen loss

Approximately what proportion of Nitrogen fertiliser you apply do you think is...

113 respondents

Average proportion of N fertiliser considered to be lost to each pathway



73% of respondents believed more than 50% of applied nitrogen fertiliser goes to the crop
19% thought more than 70% goes to the crop
93% believe less than 25% of N is lost to leaching or run-off
94% believe less than 25% is lost to the air
83% believe less than 25% is tied up in the soil

Plant growth regulation

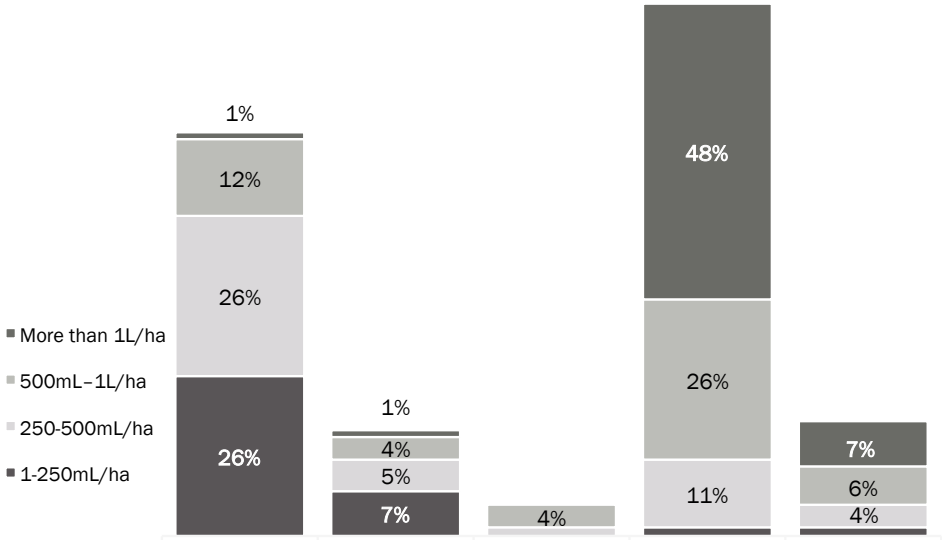
Use of plant growth regulators

In this same 'most typical field' referred to in the [nutrition] question, please indicate the rates of mepiquat chloride plant growth regulators (eg Pix, Reign, Mepiquat 38, Reward) used on cotton for each application / stage last season.

Was this field irrigated/partially irrigated/dryland?

Respondents:
81 Irrigated
5 Partially irrigated
6 Dryland

% irrigated respondents using PGRs at each stage and rate



	Early season, 1st application	Early season, 2nd application	Early season, 3rd application	Cut-out, 1st application	Cut-out, 2nd application
More than 1L/ha	1%	1%	0%	48%	7%
500mL–1L/ha	12%	4%	4%	26%	6%
250-500mL/ha	26%	5%	1%	11%	4%
1-250mL/ha	26%	7%	0%	1%	1%

In their most 'typical' irrigated field:

65% of irrigator respondents applied plant growth regulators (PGRs eg Pix, Reign, Mepiquat 38, Reward) early season. 17% also applied a second early season application and 5% applied a third early season application.

86% applied PGRs at cut-out, with 18% also applied a second cut-out application.

74% used a rate over 500ML/ha at cut-out. 13% used these rates early season.

% partially irrigated and dryland respondents using PGRs at each stage, rate

	Early season, 1st application	Early season, 2nd application	Early season, 3rd application	Cut-out, 1st application	Cut-out, 2nd application
PARTIALLY IRRIGATED					
1-250mL/ha	20%	0%	0%	0%	0%
250-500mL/ha	20%	20%	0%	0%	0%
500mL–1L/ha	0%	0%	0%	20%	0%
More than 1L/ha	0%	0%	0%	40%	0%
DRYLAND					
1-250mL/ha	0%	0%	0%	0%	0%
250-500mL/ha	50%	0%	0%	17%	0%
500mL–1L/ha	17%	17%	0%	0%	0%
More than 1L/ha	0%	0%	0%	67%	0%

Approximately when was this field planted?

111 respondents

77% of respondents using PGRs had planted in October:

7% planted before mid-September
8% mid to end of September
56% early to mid October
21% mid to end of October
5% early to mid November
2% mid November or later

What was the cotton variety in this field?

111 respondents

79% of fields receiving PGRs had the cotton variety Sicot 74BRF, the balance were:

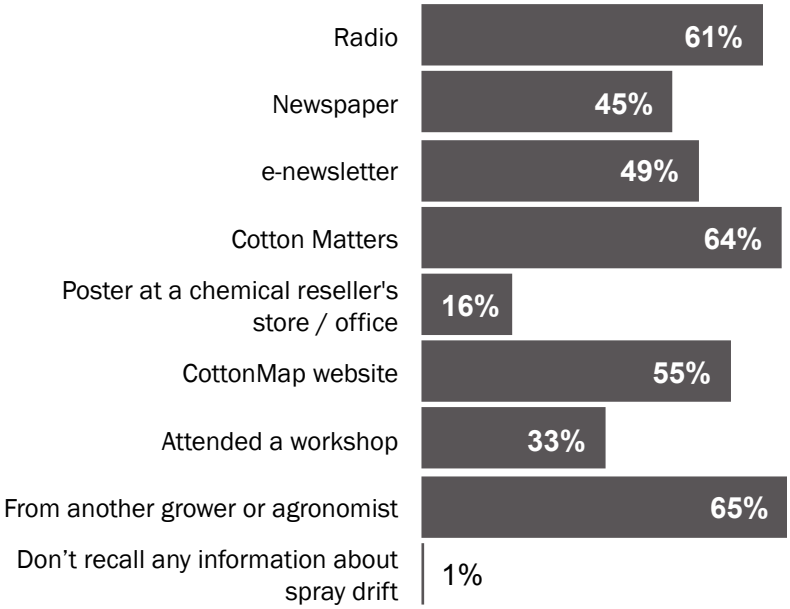
7% Sicot 746B3F 5% Sicot 75BRF 4% Sicot748B3F
4% Sicot71BRF 1% Sicot75RRF

Chemical application management

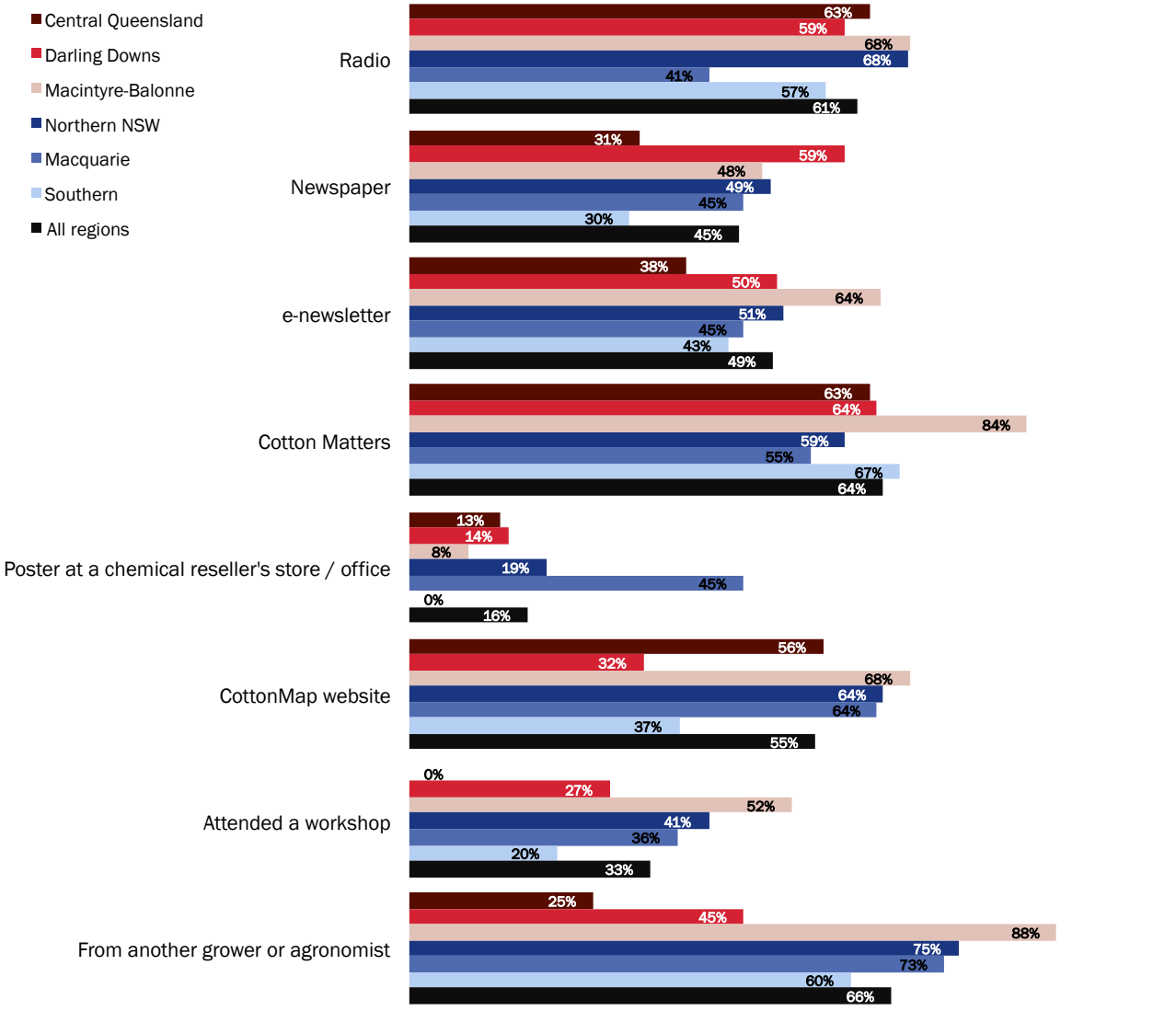
Recall of spray drift information through different channels

In which of the following do you recall hearing or reading about spray drift management last season?

175 respondents



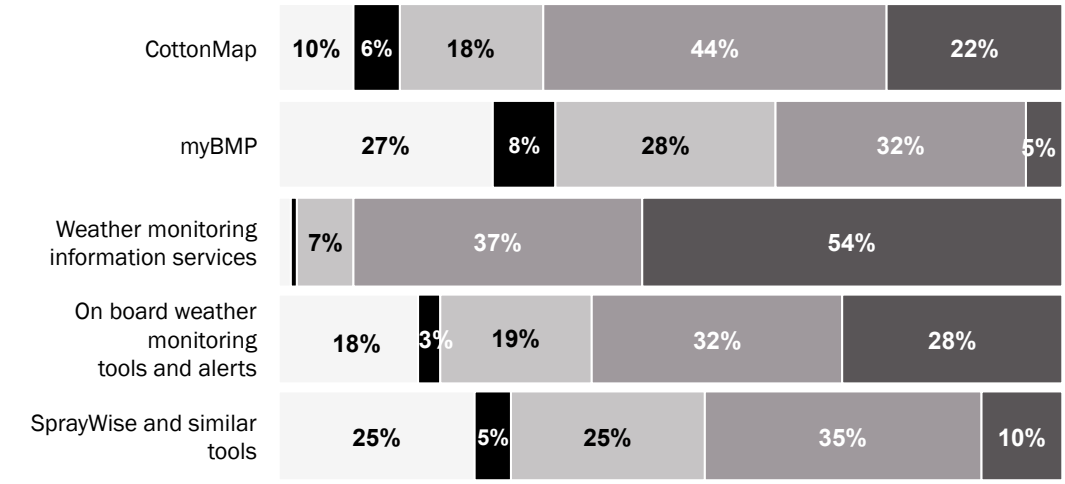
% respondents in each region who recall hearing about spray drift management last season through each format



Usefulness of tools to reduce off-target chemical drift

How useful have you found the following in managing the risk of off-target damage from chemical drift?

175 respondents



	Don't know	Not useful	Limited use	Useful	Essential
CottonMap	10%	6%	18%	44%	22%
myBMP	27%	8%	28%	32%	5%
Weather monitoring information services	2%	1%	7%	37%	54%
On board weather monitoring tools and alerts	18%	3%	19%	32%	28%
SprayWise and similar tools	25%	5%	25%	35%	10%

Other tools identified as useful included

- Knowing what type of crop is where is very helpful
- Getting out and physically checking conditions
- Drift agents
- Visual identification and experience
- cotton growers association weather stations
- Prior knowledge learnt from spray workshops. All operators should have this and only apply within these parameters
- Awareness of your surroundings
- Weather websites
- Hand hold weather measuring tools
- Correct boom setup, nozzle selection ,water rate, pressure, boom hygiene & speed etc
- Local knowledge. Talk to local farmers
- Agronomist reports
- Plan your spray week with your weather forecast on the Sunday night prior to the week for spraying
- Different chemistry
- Visual recognition and use of smoke to see inversion and wind direction
- Agronomist recommendations
- Communication with surrounding farms
- Chance of inversion information/forecasting
- Paddock observations such as stubble or trees moving from wind
- Nozzle selection.

Improving CottonMap and/or BeeConnected

How could CottonMap and/or BeeConnected be improved?

82 respondents

Suggested improvements to CottonMap and/or BeeConnected are listed on the next page. Broadly, these suggestions related to:

Raising awareness

- Suggestions to increase awareness amongst both cotton growers and others
- Several were not aware of Bee Connected.

Increasing participation

- Broader participation to make it more comprehensive was seen crucial to the value. *"Cotton map is only good if people look at it."*
  "The area listed on Cottonmap needs to be as comprehensive as possible"
- Making CotonMap compulsory either for growers or agronomists
- Expand to include all crops "*Place all susceptible crops (meaning all crops) on Cottonmap. All crops are susceptible to herbicide drift."*

Ease of use

- Making it easier and more effective to input fields – the tool was considered to be 'clunky'.

Improvements to the systems.

- Several ideas to improve the functionality of the system including linking with spray orders or weather sites, being able to add more fields without losing existing ones, mapping crop damage, linking CottonMap and BeeConnected and including other crops.

Suggested improvements to CottonMap and BeeConnected

Raising awareness

Be advertised more so more people know about it
CottonMap and bee connected are both great, but require the input/awareness of other industries (grains/bee keepers) which is difficult to achieve.
As cotton growers we are always aware of drift problems as a matter of course
Maybe by including other crops it would encourage dryland cereal growers to use it more often and see where the cotton is.
I believed it's not cotton growers that cause problems with 2-4D its neighbouring farms that miss the point about the impact on cotton. So any awareness to the wider community would help
We register our crop on CottonMap but have no idea whether anyone looks at it. Could be advertised more
I am very isolated from other cotton growers and people who might have an impact on my crop wouldn't think about CottonMap. It is up to me to inform the agronomists in town what I am growing and they need to educate their clients or purchasers of chemicals as to the risks associated with certain chemicals. I do use CottonMap when I grow cotton but education of non-cotton growers is essential for its success.
Not sure as I haven't used it. I don't use much technology at all.
Need to educate dryland growers
Cotton map could email all farmers in cotton areas and let them know about what cotton is in maybe
More promotion through GRDC so grains industry is aware of it
I think cotton maps is a good idea however don't believe the people who need to be looking at the map are not necessarily the people doing so. Particularly in our region being Condamine
Map in local paper
I don't know about BeeConnected, so maybe more publicity of this
Haven't heard of BeeConnected, so that might be a starting point.
What is BeeConnected?

Other

We are only a new user of Cotton Map for the 2016-17 season, so can't comment. Haven't heard of BeeConnected
I haven't used these
Don't use
Have never personally used either
Cotton map is just a feel good thing for the industry. If a farmer is going to spray he is not going to go and look at cotton map first. The most damage we have had has been with a plane that wasn't decontaminated properly so cotton map wouldn't have made difference.
CottonMap is good
In 2008 we lost all our cotton to spray drift. Since then, there is a lot more awareness to drift management.
However, when timelines get tight, there is always a risk that poor spraying behaviour will occur.
It's fine
Good now, new dry land growers a concern that they may not enrol.
Improvement will be generated in time

Increasing participation

CottonMap should be made compulsory to fill out when TUA or planting audits are done.
Then the chemical resellers should print and post to all people on their data basis.
Make the seed re sellers or agronomists fill in the cotton map and audit it!
They know where it is going in the ground so complete the missing link. > 50 yo growers are not going out of their way to tell the world where their cotton crop is. They are paranoid enough as it is.
Something is not working here and growers will not change. The tool is ok but the industry need to improve its reliability
Don't know how many people actually take much notice of cotton map and there are fields that do not get put on
Make it a rule if you grow cotton or have bees use the map. It is your best defence against spray drift
Place all susceptible crops (meaning all crops) on Cottonmap. All crops are susceptible to herbicide drift
Need to get growers or consultants to enter fields on cotton map. Always fields planted that are not on the map.
Just need everyone to use it.
The area listed on Cottonmap needs to be as comprehensive as possible. Not sure how this is maximized. The awareness campaigns that currently run are pretty good.
Need 100% participation
I think it needs to be pushed more by resellers and private agronomists Non cotton growers in this area don't know about it, and agronomists from this area are the same. Out of district agronomists still have there head in the sand.
If more people used it before fallow spraying
Cotton map is only good if people look at it
Logging planted fields of cotton onto the website must be made mandatory so that a complete map of cotton planted is available to all who use the tool so that correct decisions can be made
Get everyone to use it
If all broad acre growers would use it would help
Make every reseller input the information please.
Not all cotton is put on CottonMap. Maybe the technology providers should be required to put it on at the planting audit??
The problem is the people who use cotton map understand the risks. How do you target the people who can't or won't improve their spraying practices?
BeeConnected could be improved if people used it, everytime I check it there is no data for our region? Not sure if bee keepers are trying to hide their hives or what it is.
BeeConnected could be improved by enforcing full participation from bee keepers
Bee keepers need to put hives on BeeConnected
The bee keepers could update the bee connected and alert growers when they move hives, (we don't move cotton crops)
All bee boxes on it and access on App

Spray applicators

All spray rig contractors to log on a spray registered site
Adding information is good, but it has to be used by those applying the sprays.

System improvements

CottonMap - work out a way to stop fields of cotton disappearing off the map when new ones are added. If I have 3 fields already on the map and go and plant another paddock to cotton, when I add the 4th paddock to cotton map all of the original 3 fields disappear waiting for the administrator to approve them. the administrator is usually quick to approve but there are times when I see maps printed off that do not have the correct areas marked - purely because some one accessed the CottonMap website while a grower was updating his cotton areas.
CottonMap only - not familiar with BeeConnected
The addition of other crops would be helpful.
Also the addition of 'Reported Incidents' - location
Link the map to weather sites e.g. OzForecast etc.
Not familiar with BeeConnected but I think that CottonMap could have a print out of regions after planting in local papers for farmers to look come across. A lot of farmers do not use the internet for programs like CottonMap
Make sure all previous years fields are deleted before next season
Could link it to spray orders
BeeConnected should show locations of beehives automatically, or notify us when hives move into our area (say 10km distance from our properties). Any updates to activities we enter for spraying insecticides should only be distributed to our local area. More info about how the system works should be more available.
Place all crops on Cotton map as all crops are sensitive, or at least give growers an option to put other sensitive crops on it.
Cotton map relies on people putting the correct information in, sometimes they forget fields or put the wrong ones in, maybe a aerial shot would be more correct.
It would be good to be able to map the crop damage on Cotton Map. Or at least indicate where or which fields have shown signs of herbicide/phenoxy damage. I haven't really used the BeeConnected site.
If you could map in other sensitive crops that would be useful.
Expand CottonMap to all cropping . It would be a more inclusive tool and very useful for drift sensitive crops of all types
Maybe a distance measuring tool could be useful.
Overlaying the CottonMap with bee sites would be good
Link the two sites together. When you look at one the other pops up. i.e. When Cotton Map opens the bee connect website flashes some how and you need to acknowledge this before moving on and vice versa. It is another way to remind you.
CottonMap needs to display what tech is where

Useability

Easier to use
Make cotton map easier to input fields
No registration for use. Too many logins and passwords to remember already
I've found CottonMap an extremely frustrating site to use & place fields, I'm sure this could be improved.
If is was an app
Log on easier
I do have some difficulty putting in my fields.
Better understanding on how to use.
Not a power user of the product but very clunky. Should be able to save all maps to system and make them active or inactive on a seasonal basis.
BeeConnected - have never utilised, but initial investigation of product-would prefer a similar set up as CottonMap. I want to know where they are but not necessarily be put in contact with the apiarist
Once a field is entered in Cotton Maps should be able to select if sown the following year rather than re mapping. In my part of the world bee keepers need to use BeeConnected to be of any use.
Phone app for CottonMap
Ensure previous years crops are removed

Managing surface temperature inversions

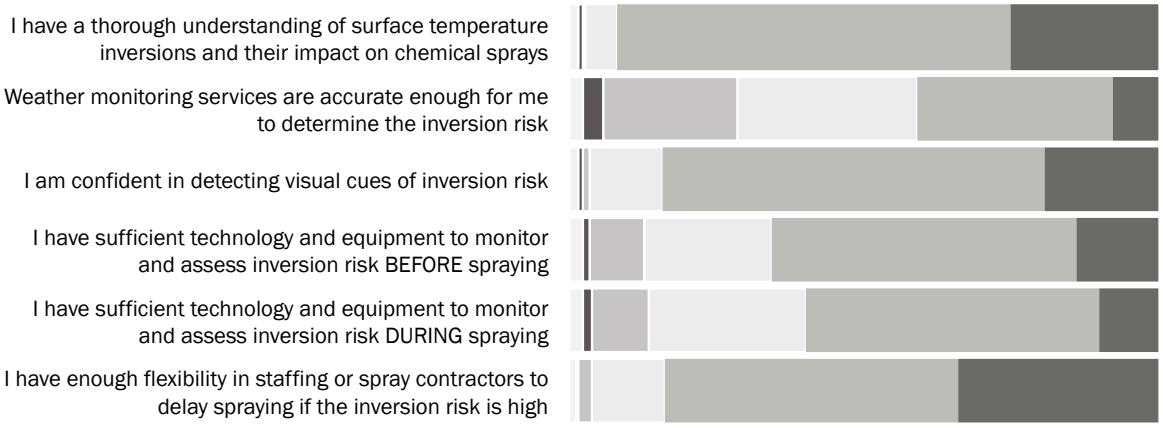
Please indicate your views on each of the following statements relating to surface temperature inversions during chemical spray application.

171 respondents

85-90% of respondents were confident in their knowledge and understanding and staffing flexibility for spray application management.

59% believed weather monitoring systems are not accurate enough for determining inversion risk

60-66% believed they have sufficient technology and equipment to monitor and assess inversion risk.

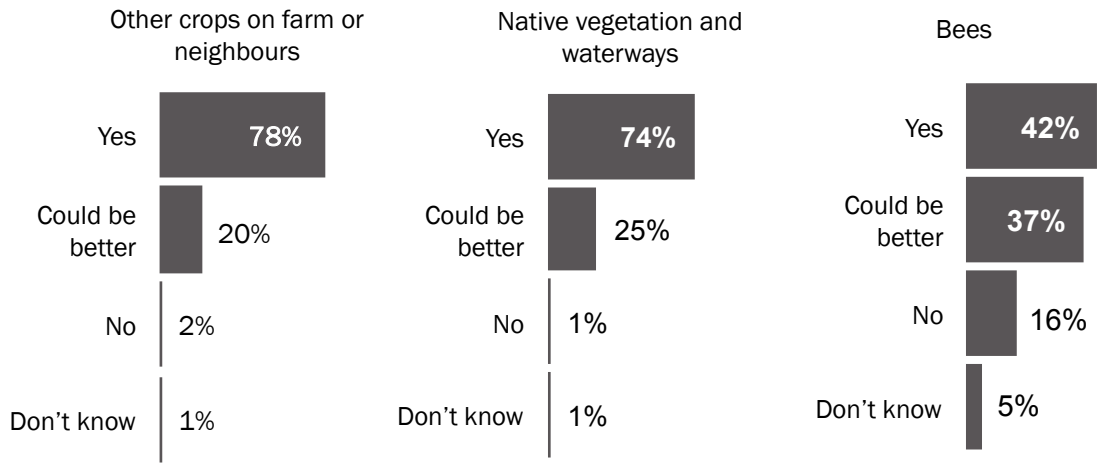


	Don't know	Totally disagree	Disagree	Neither agree or disagree	Agree	Totally Agree
I have a thorough understanding of surface temperature inversions & their impact on chemical sprays	2%	1%	1%	5%	67%	25%
Weather monitoring services are accurate enough for me to determine the inversion risk	2%	4%	23%	30%	33%	8%
I am confident in detecting visual cues of inversion risk	2%	1%	1%	12%	65%	20%
I have sufficient technology and equipment to monitor and assess inversion risk BEFORE spraying	2%	1%	9%	22%	52%	14%
I have sufficient technology and equipment to monitor and assess inversion risk DURING spraying	2%	2%	9%	27%	50%	10%
I have enough flexibility in staffing or spray contractors to delay spraying if the inversion risk is high	1%	1%	2%	12%	50%	34%

Sufficiency of resources to minimise the risk of off-target chemical drift or overspray damage

Do you believe you have sufficient information, equipment and technology to minimise the risk of chemical drift or overspray damage to...

174 respondents



Suggestions to manage chemical risk

What more can the industry do to help in managing this risk?

81 respondents

Individual suggestions follow. Comments related to:

- Education and awareness was suggested most frequently – for both cotton and other growers
- Improved weather monitoring information and inversion alert systems
- Information tools
- Changing the practice and culture of chemical management
- Compliance and regulation
- Awareness and information about bees and for apiarists
- Collaborating with other industries, in particularly grain growers
- Technology such as inspecting and upgrading nozzles
- Talk Group I not 2,4D.

Suggestions of what industry can do to help mange risk of chemical damage

Weather monitoring & risk alerts

Improved weather monitoring and inversion prediction
Localised sms alerts when inversion conditions are present
More weather stations, incentivise those with private sites to let the public see them www.boolah.com.au/weather.html
Inversion alert systems available to all farmers and spray operators
Have a radar out here
Easy access to local weather stations, good forecast and easy recording of actual conditions
Have alerts (with weather stations) when temperature inversion conditions exist.
Localised sms alerts when inversion conditions are present
More localised weather stations that can update very quickly
Inversion towers
More advertising, inversion monitors on every OzForecast weather station. Inversion risk times and days should be part of local weather announcements on Rv and radio.
More regional weather stations.
Develop inversion forecasting techniques.

Practice & culture

Actually doing the right thing, too many people are prepared to take risks especially when the pressure is on.
Common sense and awareness, as well as communication between neighbours
Reach stubborn people
Night spraying is the major offender I believe with drift.
Cultural change is required. An attitude that it is unacceptable to cause off target drift. Must be prepared to stop spraying when conditions are not right
Target the right people
Reduce chemical use!
Convince the deniers that they have to improve. Problem on Darling Downs is drift/inversion event is occurring many K's away and off target pesticide movement is doing damage long way from application often. These people don't believe they are close enough to susceptible crops, and keep doing what they've done for ever with the normal fan jet nozzles that have been in the sprayer for ever. Good luck with that.
Planting and crop notification to neighbours.
Not sure - growers should be aware by now.
Grower awareness, once you have had an incident it is certainly a big wake up call. Don't be too complacent.

Compliance & regulation

Unfortunately, the next step to stop this risk is a successful legal prosecution of the offender
The quicker chemicals can be traced to batches I think the better off we will be.
Employ an individual, privately employed by maybe a grower group or similar to actively patrols problem areas undertaking observation and dealing with problem operators. The thought of the man watching you should keep them on their toes. If you consider the individual losses in monetary figured you could put a percentage of the average yearly loss towards this patrol individual.
I think we need more regulation - chemical register at resellers for phenoxy products; proof of chemcert or accreditation for both purchaser and applicator; technology tracking when applying; more weather stations with inversion text alerts.
Be more pro active in informing the EPA when there is a problem.
Start implementing fines for drift damage
Catch the [people] who don't care
Get @$!#! spray contractors and farmers prosecuted to make a statement and will have less drift issue
Get EPA involved
Limit 2,4D
Stop selling 2-4 D to people in summer, or have a register of those who buy it maybe

Technology

Lobby Bayer to release Liberty as a broadacre fallow spray in late season and high risk situations. Ban the sale of hormone products to people who have not done a spray drift management course. Provide low drift nozzles to hobby farmers and graziers in the hills.
Ban fine nozzles. Greater education
I believe CRDC & GRDC should run a combined on farm boom nozzle inspection & upgrade on old obsolete flat fan XR flat nozzles, to appropriate modern AI low drift nozzles etc.
Ensure all applicators select nozzles from the coarsest end of the range and work back if needed, not start at the fine end and work up towards coarse! Coverage is not important, efficacy is important.
Make nozzles cheaper so that people can afford to spray with the correct one.

Information

More practical and visual information on trials that have been conducted in the farmers region.
Be very active in promoting the tools the industry has.
A simple info card that could be kept in spray rig that gives the basic rules of thumb could be helpful to the untrained (probably already is available)
More seminars & practical demos on spraying. Tools like Spraywise need to be free and easy to access by anyone.
Bring back helix.

Bees

More online and readily available information could be provided in regards to issues such as Bee's and ways to limit the effects of spraying may be having on them.
Faster access to bee tracking
Bee operators need to make people aware of where their hives are located
I am not aware of where bees might be.
Apiarists need to take more ownership of this problem as we have had issues where they have placed bees on our farms without any notification.
Educate Bee Keepers.
Bees on roadsides dropped off in the night make it hard

Education & Awareness

Need to educate all people who use these chemicals
Work alongside other industry groups like GrainGrowers and Agforce to help with education and awareness of their spraying practices
Workshops , media release cotton mags, grower forums
Mandatory workshops for all people who use phenoxy type herbicides
Start talking Group I instead of 2,4D; Education regarding Low Volatile (some think that Low Volatile means no risk); Traffic lights on drums; Stop talking US and THEM; Education regarding residual effects of various products on cotton - plant-back areas on labels needs MAJOR attention; Boom height and speed; Night Spraying???
Grower forums and Cotton Matters are the best way
More education on inversions and technologies that are available
Education
Education, education, education. Just keep at it, all the time.
Keeping the issue alive
More workshops
Keep educating people
Maybe on farm training.
Very difficult to answer. Maybe educate the agronomists to communicate with their clients helping them to manage spray drift. Growers have a lot of trust in their agronomist so perhaps may listen to them more than a radio commercial.
Educate the non- conformers
Keep educating all people involved.
Keep the message out there regardless of season
More workshops need to be run by the likes of Bill Gordon and all spray operators encouraged to attend. As a last resort maybe the purchase of risky chemicals could be restricted to those that have done such a workshop. The ChemCert type workshops are a joke so not to be relied upon. Money always talks so maybe chemical price could somehow be used as an incentive??

Crops other than cotton

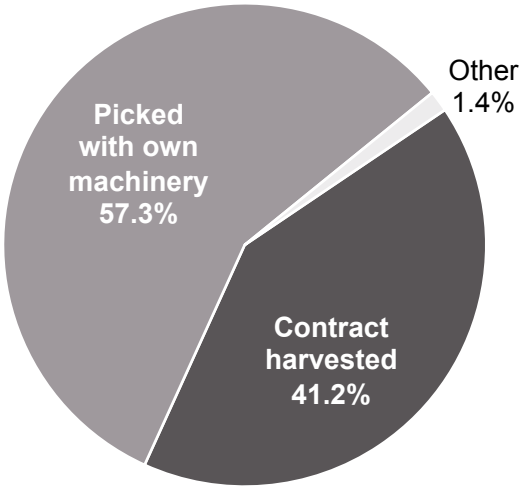
We are generally not the people causing the spray drifts. We have sufficient knowledge and technology and these are not the people causing the problem.
There is enough info for the cotton industry to manage the risk however I don't know if that also applies to the dryland grains section
Educating non cotton growers.
Get the dryland growers on board
Continue to educate all farmers not just cotton growers. Info about risk given out with every drum of 2,4D
Have map for other summer crops. Maybe some dryland, non cotton growers may then watch where susceptible crops are
I find it interesting that all these questions relate to me and my spraying abilities. It is my neighbours and their contractors that are the worry. Non cotton growing neighbours still have their head in the sand. Resellers in our area are still selling volatile 2,4D formulations when there are non volatile formulations available. Agronomists are also recommending other hormone products in the area, in the belief that they don't hurt cotton. On way to minimise this is to stop referring to drift as 2,4D drift and refer to it as hormone drift, or Group I drift. All Group I herbicides have the ability to hurt sensitive crops and people need to be educated more and more about these effects. I believe resellers and private agronomists need to be made more responsible. All an agronomist needs to do is write on his recommendation "beware nearby sensitive crops" and he is off the hook in terms of chain of responsibility. That to me is bullshit. They shouldn't be able to recommend Group I chemistry to any old farmer. They should have to be satisfied that a grower/farmer/contractor is responsible enough to use these herbicides. In our situation we spray every Group I chemistry in and around our cotton, and to date have never hurt our own cotton. We have however been damaged by a lot of neighbours over many years. Preach more to unconverted that live a long way from cotton.
Possibly more education. However I think it is not just a cotton industry problem it is a valley/region problem which requires cross industry collaboration.

Harvesting

Average proportion of crop harvested with own machinery vs contractors 2015-16

Approximately what proportion of your cotton did you harvest using contractors vs your own pickers in 2016?

112 respondents

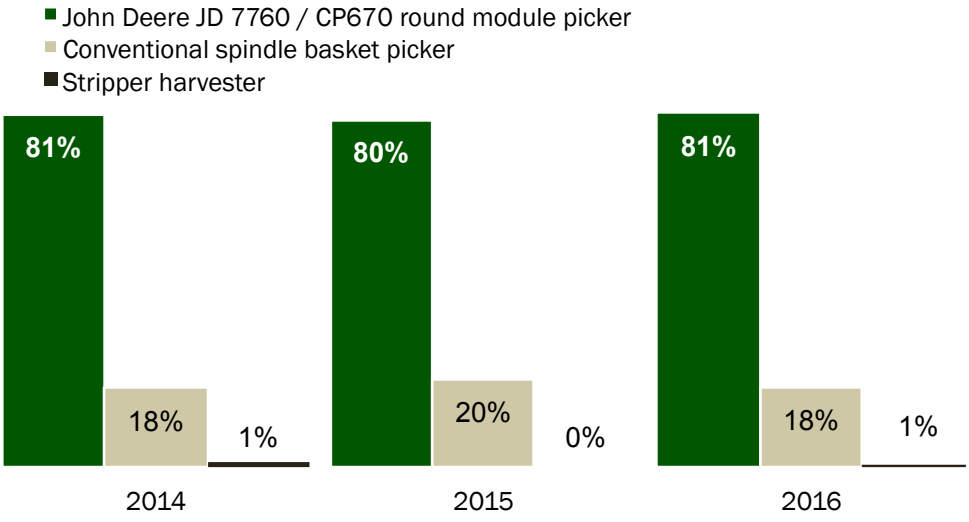


Harvester type used over past 3 seasons

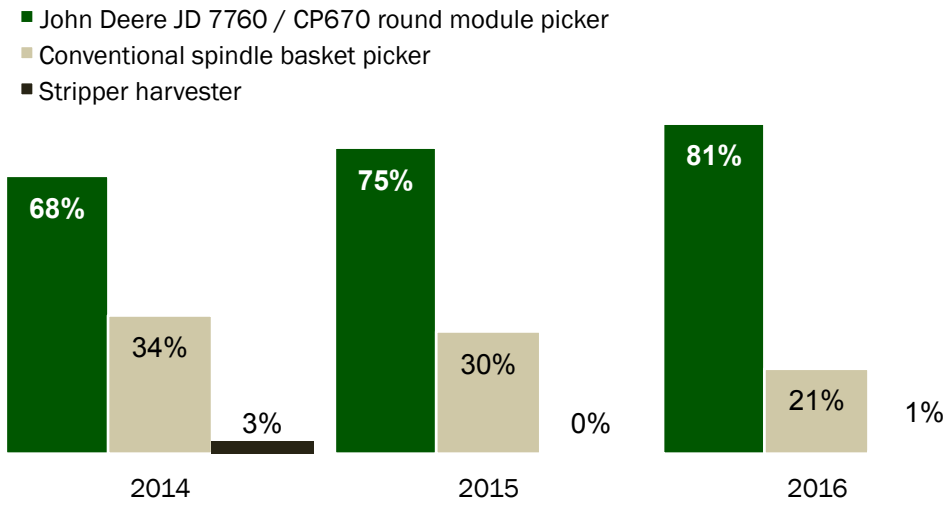
Approximately what proportion of your cotton did you harvest using contractors vs your own pickers in 2016?

131 respondents

Proportion of cotton ha harvested with each picker type



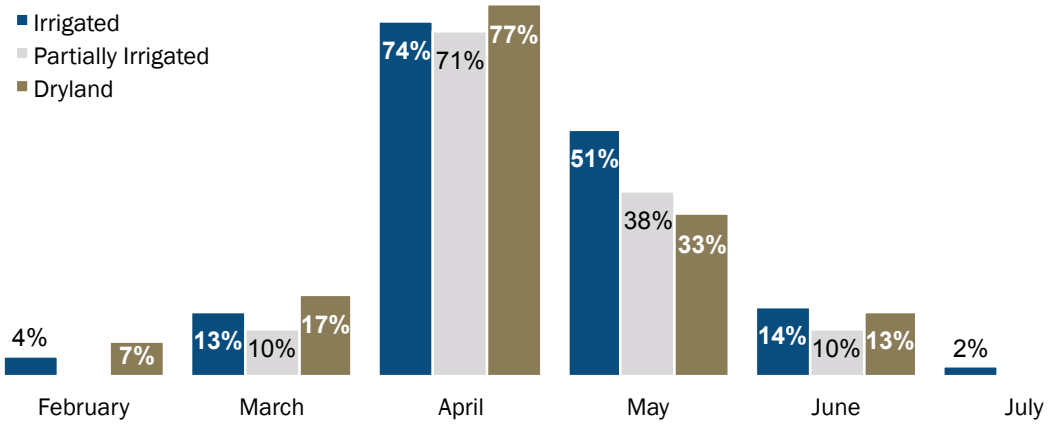
Proportion of farms using each picker type/s in the past 3 years



Time of harvest 2015-16

In which month/s did you harvest cotton last season?

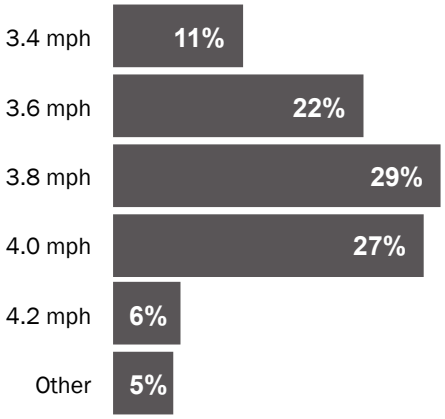
111 respondents



Speed of harvester travel

What groundspeed do your harvesters generally travel at when picking cotton?

133 respondents

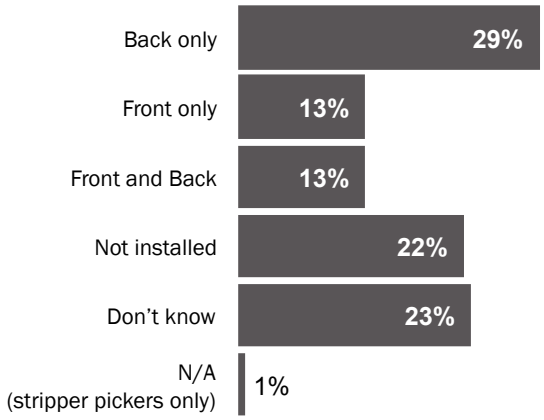


"Other" =
Haven't checked
7 km per hr (=4.3 mph)
Don't know (X2)
Not sure
From 3 to 4 mph depending on crop conditions
Depends on crop!

Scrapper plates installed on harvester/s

Are scrapping plates installed on any of your harvesters?

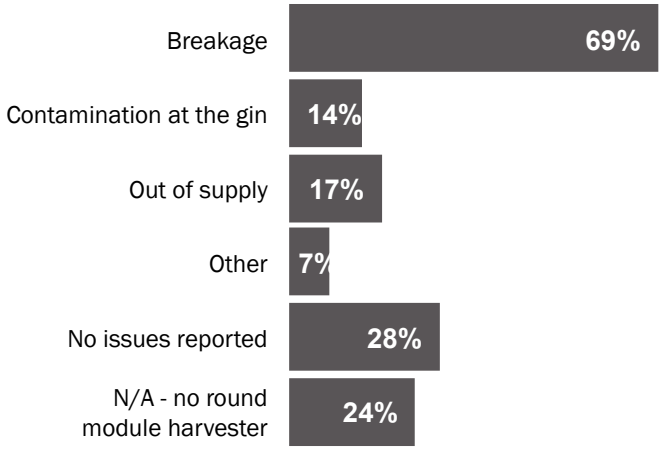
136 respondents



Issues with plastic module wrap

Have you experienced any of these or other issues with plastic module wrap?

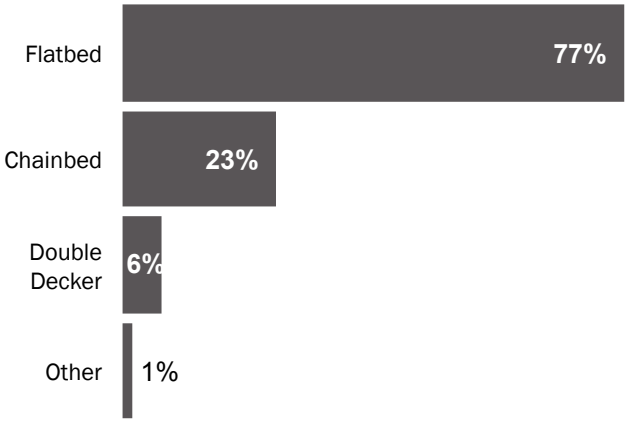
110 respondents



Truck configuration to transport modules to gin

Which truck configuration/s do you or your transporter generally use to transport cotton modules to the gin?

137 respondents

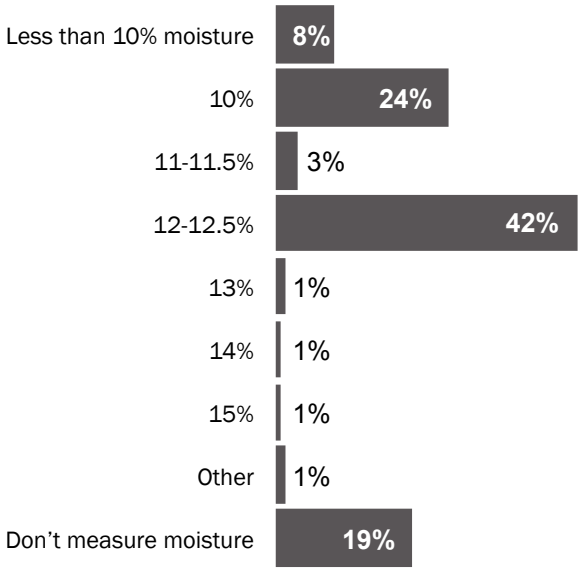


Other = road train, box frame

Highest moisture level usually tolerated for harvesting

Under most circumstances, what is the highest moisture level you will tolerate before stopping picking?

137 respondents

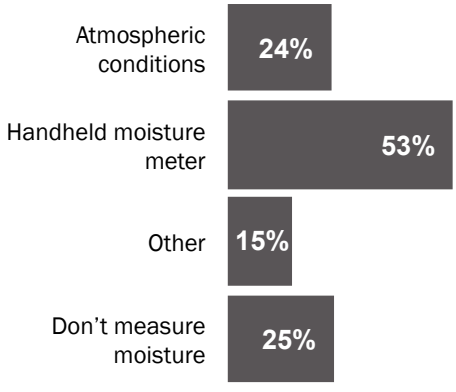


Other = depends on weather forecast

Methods used for measuring moisture prior to harvest

PRIOR TO harvest how do you measure cotton moisture, if at all?

137 respondents

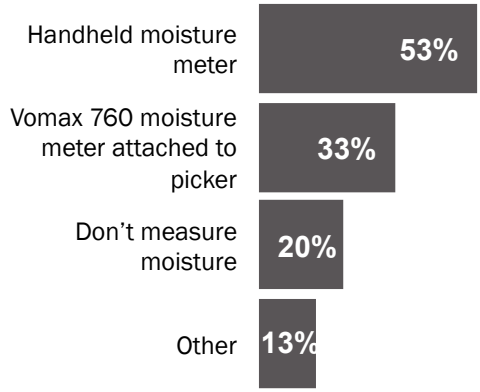


Other =
- The old fashioned way
- By feel (x5)
- By hand (x3)
- Feel, seed hardness
- Cut bolls
- Manual / hand sample
- Experience
- Contractor's experience or agronomist
- The picker tells us if we can pick
- Vomax on picker

Methods used for measuring moisture during harvest

DURING harvest how do you measure cotton moisture, if at all?

135 respondents



Other =
- Choking
- The old fashioned way
- Feel (x4)
- Put lint against face or feel top of toolbox
- Feel and machine performance
- Nose
- Contractor
- Any sign of dew we pull up
- Time of day i.e. 10 am to 7pm

Perceived accuracy of moisture measures

Do you believe this cotton moisture measurement is accurate or do you make any adjustments for the accuracy of this measurement?

85 respondents

Yes, considered accurate

- Yes very good
- Yes it is because in evening you can pick off top bolls
- Yes it is accurate
- Yes but I have nothing to check it with
- Yes believe it is accurate, make no adjustments
- It does the job ok. we haven't ever had a problem at the gin
- Yes (x20)
- Yep it is working for me
- Calibration
- We don't get discounts for moisture damaged cotton and the gin has commented that whatever we're doing is working
- Very accurate if calibrated pre season
- Very accurate (x2)
- A good guide
- The Vomax is very good we find
- Takes out the risk for us pulling up early
- I believe it's accurate / reasonably accurate (x8)
- Relatively accurate, haven't had any problems
- Reasonably accurate certainly better than nothing
- Only reset hand held as per directions
- OK - no quality issues last season
- Its close
- It's a good guide

Adjustments, calibration and comments

- 1. Pre harvest calibration by Volmax; 2. Check with gin
- Yes - however its important to look at weather conditions and crop conditions (eg leaf content)
- Yes do make some adjustment for atmospheric conditions
- Yes but use it as a guide only
- We have never measured moisture with conventional cotton pickers
- We are picking contractors and have had 6 years experience with the Vomax. It is excellent for monitoring when the moisture is rising and machine is about to stop but useless at any other time
- No and yes
- Make adjustments
- Make adjustments based on crop and external weather
- My hand held moisture meter is accurate but I need to allow a factor if green leaf in sample. Round modules will "sweat" and slowly increase in moisture content if green leaf is present in sample. Sometimes Lint moisture % will increase by 4 %!!
- Leave it up to picker operators
- It is just a tool so we also make a instinctive judgement
- Is a guide only
- Experience
- Err on the side of caution.
- Believe it is accurate. 36 years of cotton experience helps as well
- Contractor controls most of this but we have not had any moisture related discounts in the last few years
- Cross check with 2 units and average out to get as accurate as possible
- Accurate depending on temperature
- Compare our meter to the gins at start of season
- Calibrate with cotton gin moisture meter
- Cross reference with gin moisture levels when ginning
- Is checked and verified by supplier each season

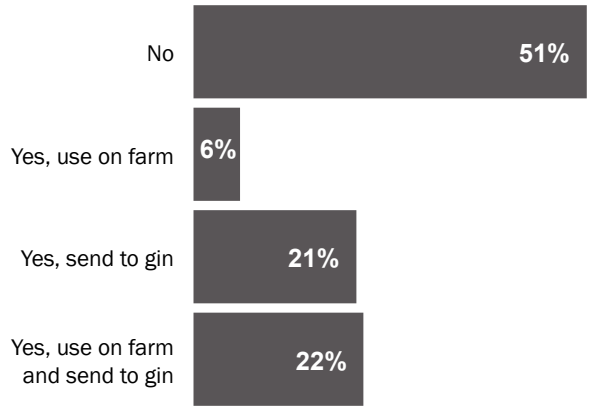
Considered inaccurate or not used

- We struggle to keep readings constant between the different monitors
- Vomax inaccurate
- No (x3)
- Not really. Feel good thing.
- Don't have moisture meters.
- No it is more proof that you shouldn't be picking. Prove what the benefit of measuring moisture is? Currently it is a marketing gimmick
- No measurements Just experience.
- Not sure
- Don't know - contractor decides
- The Vomax 760 moisture meter is poorly calibrated and cannot be trust to accurate readings below 10% moisture or above 12% moisture.
- Base on picking - visual

Use of RFID tag information

Do you record and use the RFID tag information?

141 respondents



The highest on farm usage of RFID tag information was in the Gwydir (57% selected 'Yes- use on farm' or' Yes, use on farm and send to gin') and the lowest was in Central Queensland (7%)

Uses of RFID tag information

Please tell us how do you use RFID tag information

41 respondents

Tracking and communicating with gin

- Track bales from farm to gin. Needs a more friendly system to USE the data- where are all the smartAg solutions we keep hearing about?
- To correlate picking data to ginning data, mapping fields for quality, length, leaf etc
- Tracking modules
- For our own field records & info for our ginner & marketer
- To keep a record of bales picked and where
- Track modules and check gin
- Information is sent to gin weighbridge in place of a MIF (Module Identification Form)
- To scan modules into the gin, so that we know if all bales are delivered.
- To book in the modules to the gin.
- Ginning ID
- Email to gin. Keep for records. Write each number on truck dockets.
- It replaces the use of module tickets
- Download picker data and send to gin to eliminate field tagging and scanning /faxing of module sheets
- Date and time
- To give information to the gin
- Namoi cotton system
- Ginning reports
- For traceability from the farm gate through to the gin. We also cross check the RFID count to the field count to ensure alignment of module numbers and to eliminate double wraps
- Module bookings
- simply tag modules with the ID tags and send to gin
- For sending module information to gin
- 1. Send to merchant to verify harvest of round modules to get 50% bale advance 2. verify round modules delivered to gin
- Delivery & gin yard allocation
- Provide weigh bridge with information on bale numbers

Field performance

- For field yields
- Field analysis
- To track where the round modules have come from within a paddock and how many you get from any given paddock
- Use it to record number of rounds per field/ also compare round weights per field.
- Field production / location of bales
- Yield mapping / tracking
- Check any uneveness in field
- Trial info ID

Quality

- Checking bales against quality
- Field position of bales and moisture and quality check
- Identifying bale numbers for moisture contamination etc

Information format

- If contractor has on board reader, we use that. If not, we read manually
- Early days - write them all down off each round
- Picker information
- On paper
- Download and send to gin.
- Upload .csv, modify if needed and upload to gin, when module enters yard, is scanned and cross referenced

Solar energy

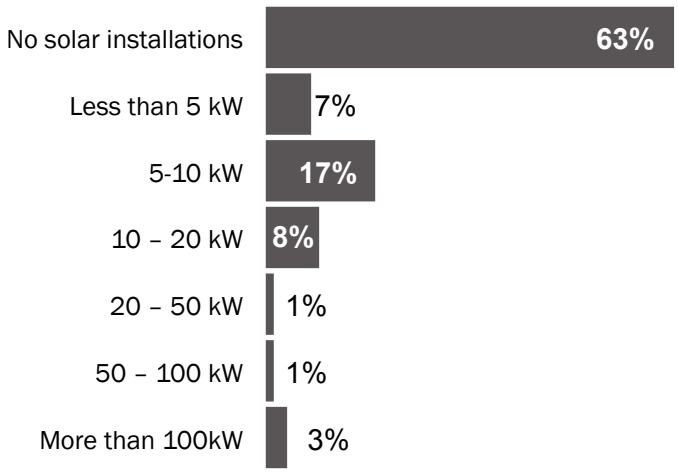
Solar power capacity on cotton farms

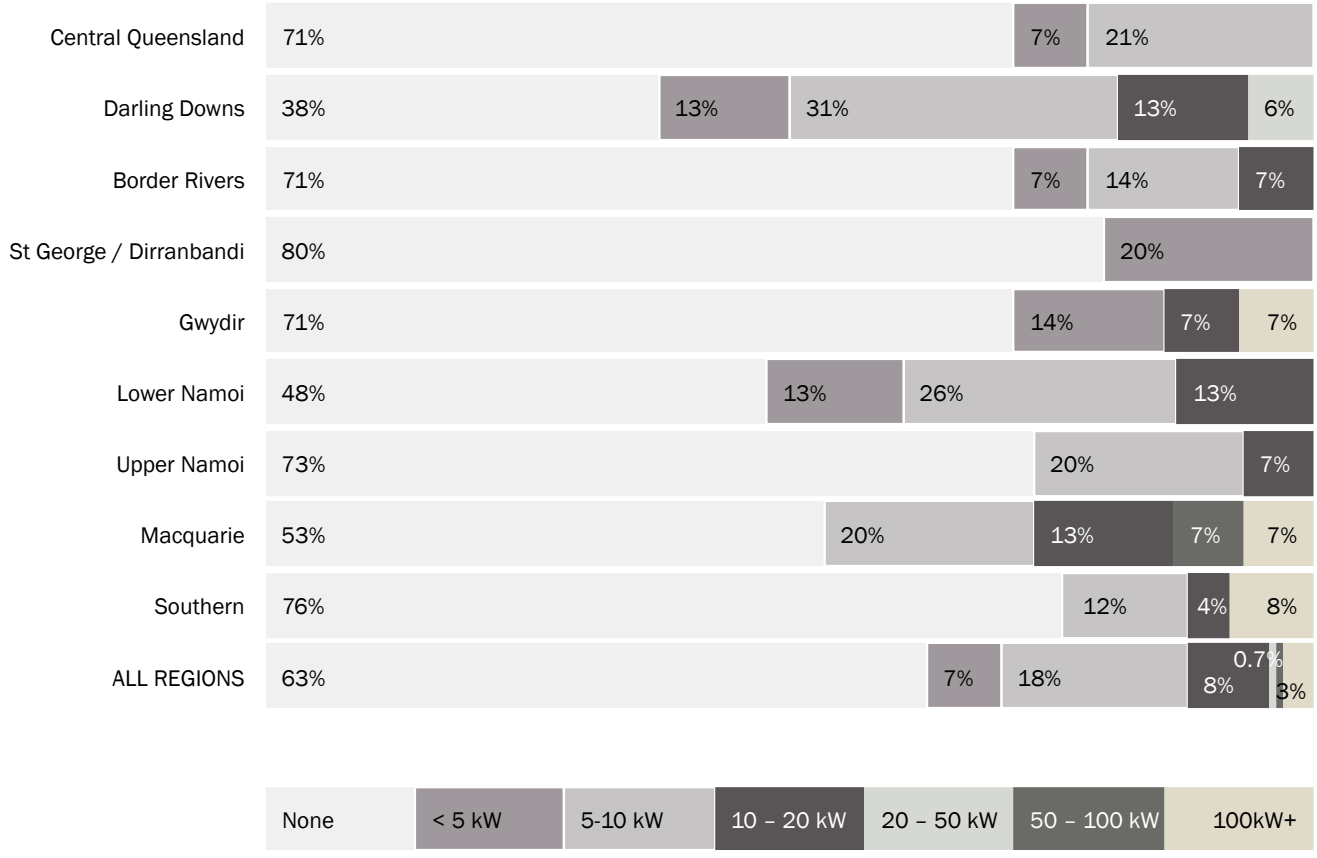
Please indicate the approximate capacity of any solar power installations on your farm.

136 respondents

37% of respondent cotton farms have solar energy installations.

The Darling Downs has the most farms with solar installations whilst all the largest installations (over 100kW) are in NSW.

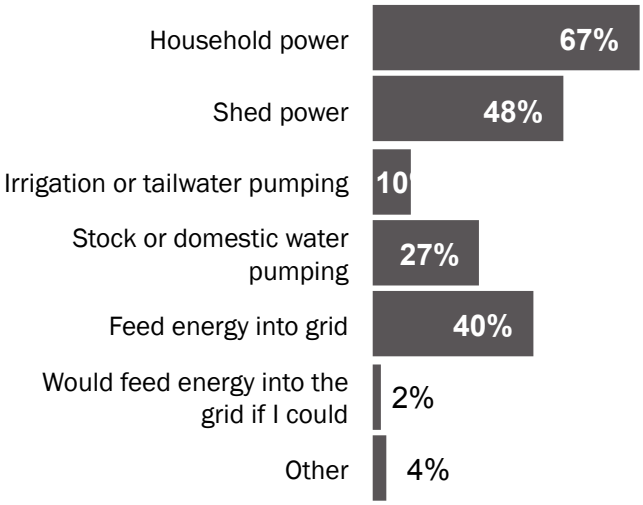




Use of solar energy

How do you use this solar power on your farm?

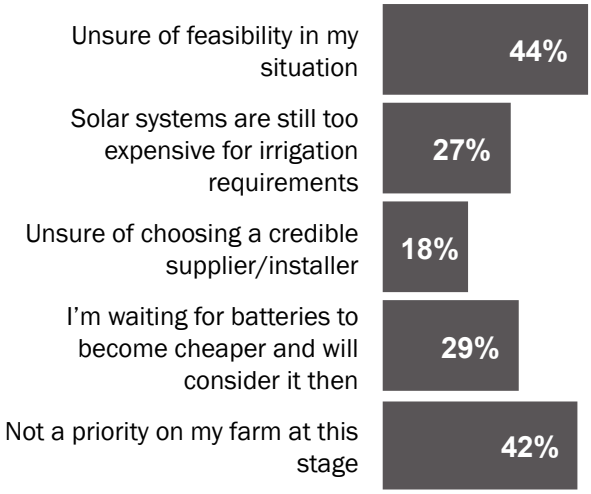
115 respondents



Barriers to investment in solar energy for irrigation pumping

Do any of the following prevent investment in solar energy for irrigation pumping on your farm?

110 respondents

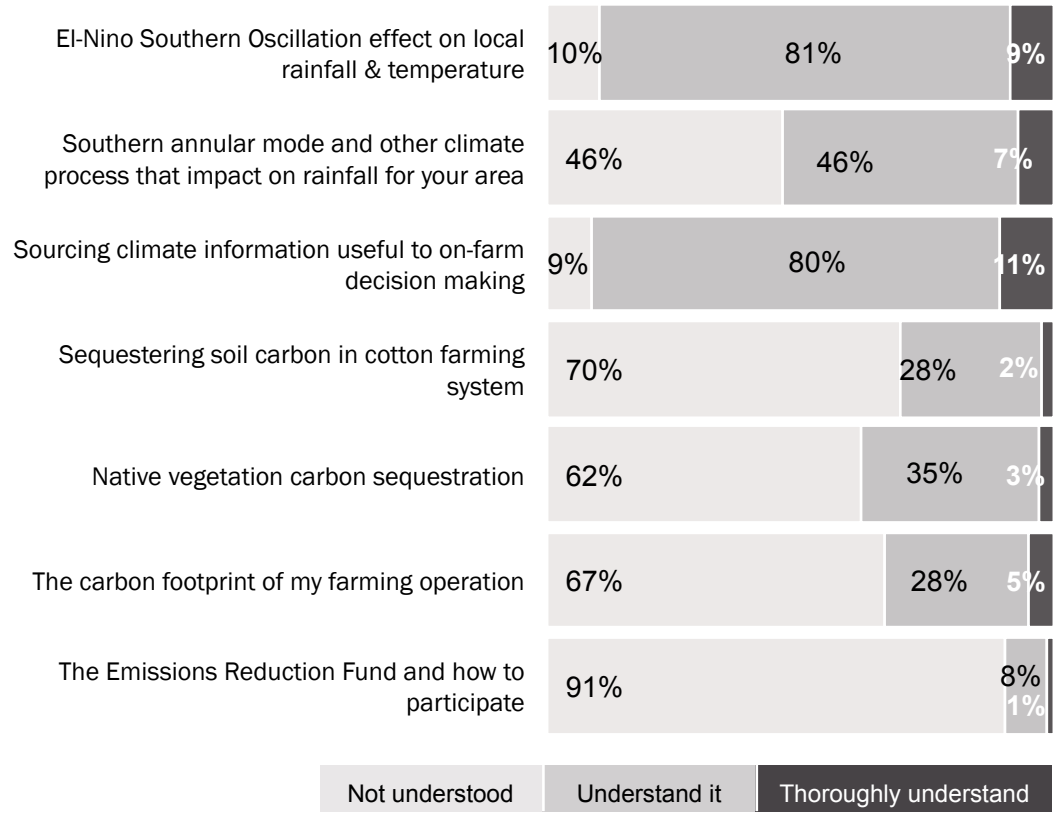


Climate and carbon

Knowledge of climate and carbon issues

Please rate your understanding of:

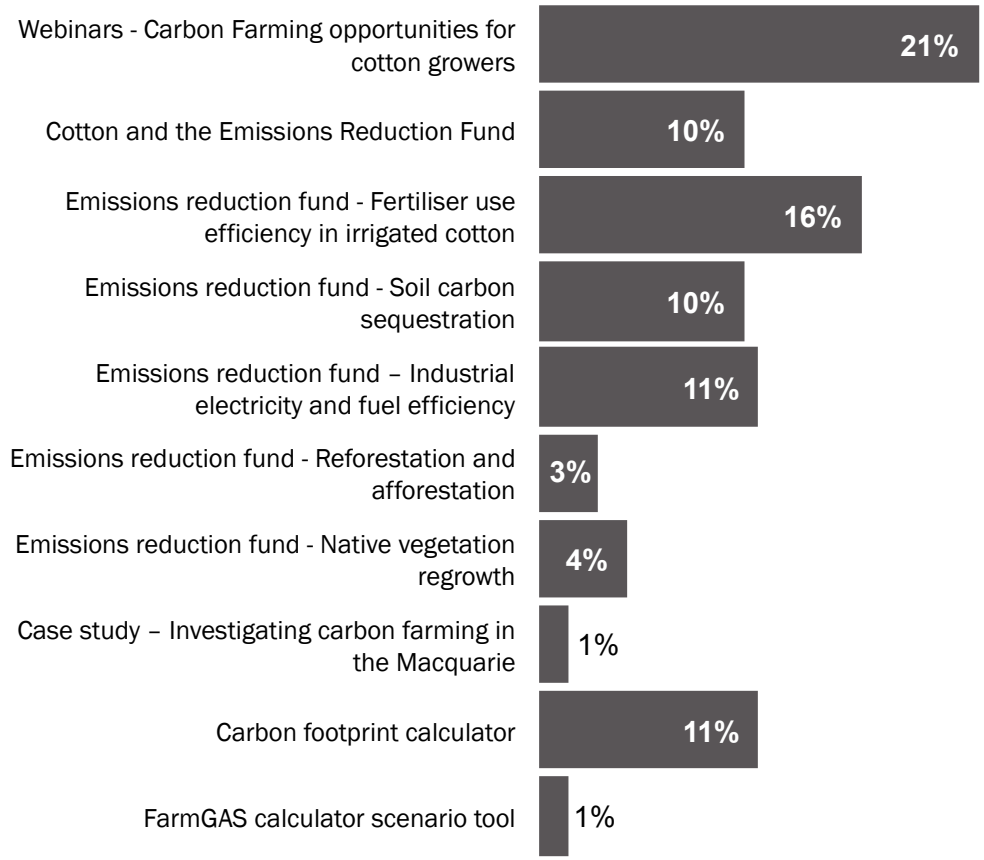
140 respondents



Awareness of carbon extension materials

In the past 12 months, do you recall reading or hearing about...

140 respondents



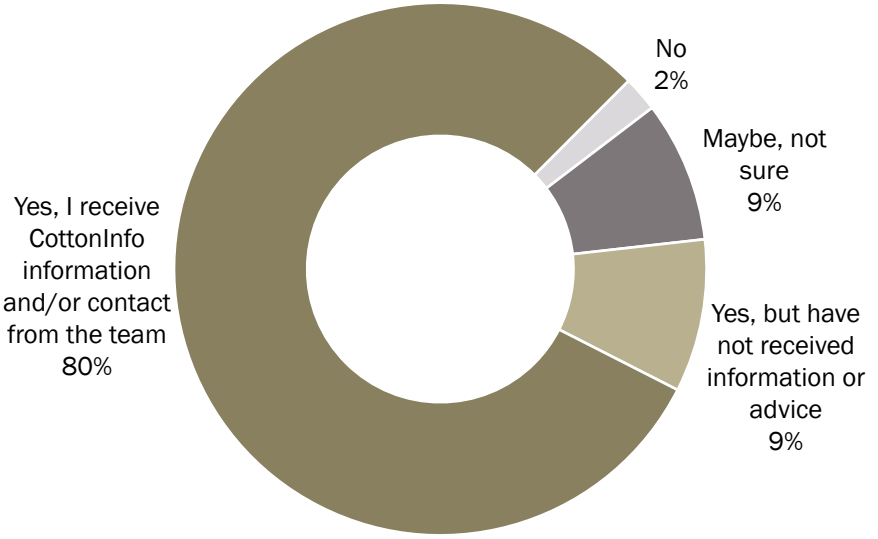
43% of respondents recalled at least one of these carbon extension resources.

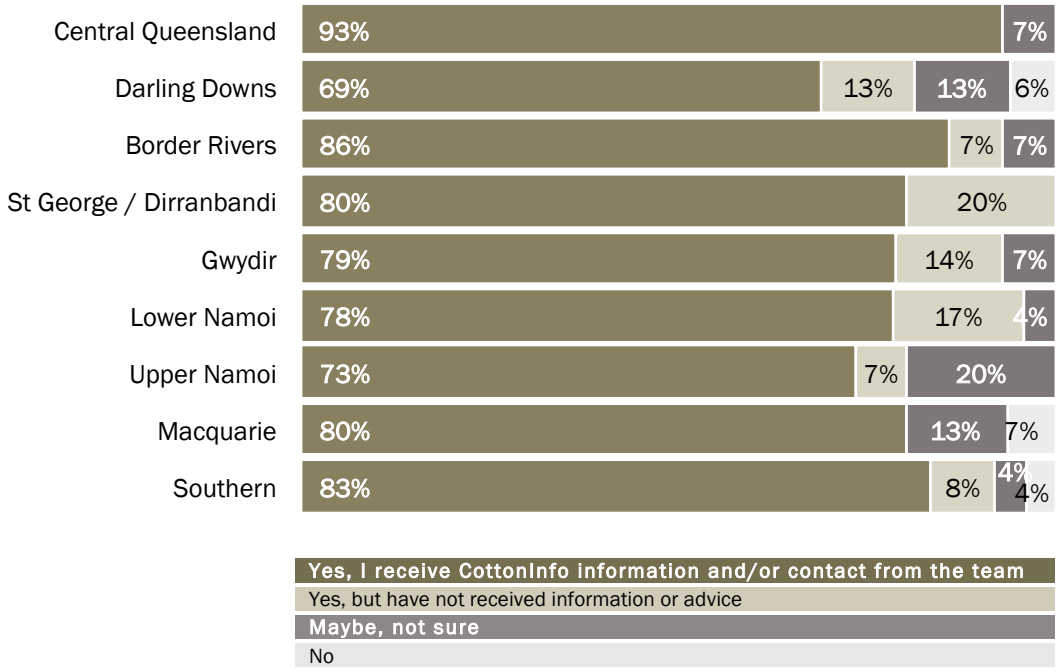
CottonInfo

Awareness of CottonInfo

Are you aware of CottonInfo - the cotton industry's joint extension program (consisting of regional development officers, technical specialists and myBMP)?

140 respondents

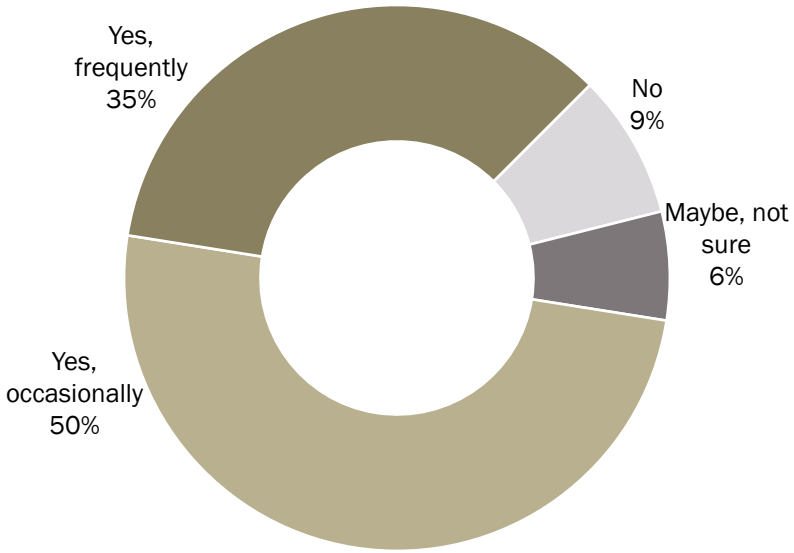


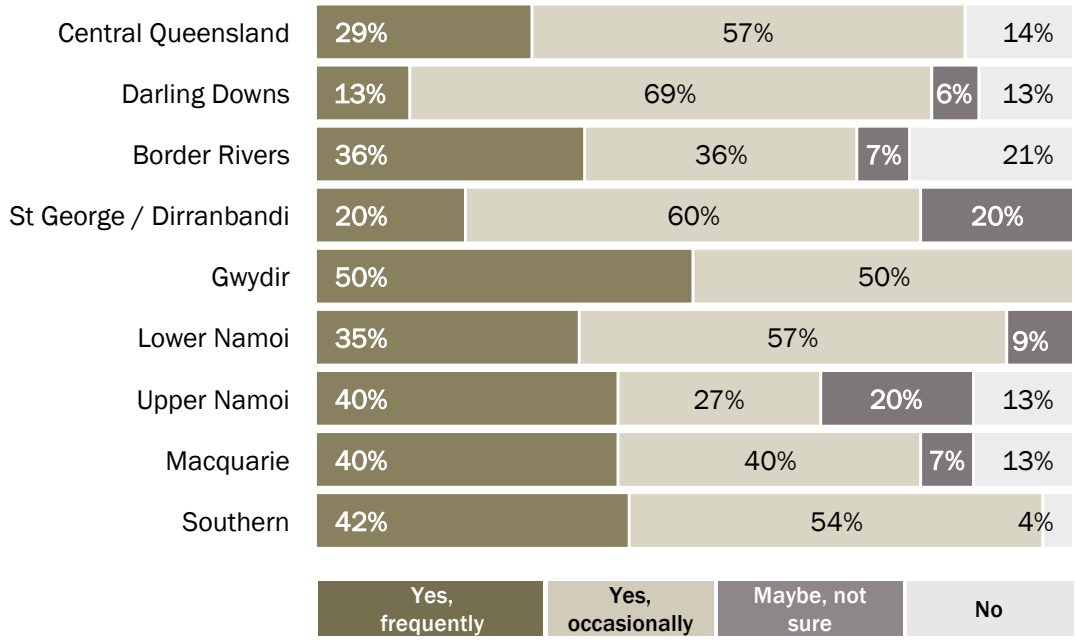


Sourcing CottonInfo information

Do you source information from the CottonInfo team or information resources (eg Cotton Pest Management Guide, Cotton Production Manual, myBMP etc)?

140 respondents





Impact of CottonInfo in improving practices

To what degree have the CottonInfo team, information resources and myBMP assisted you to improve practices on your farm in relation to...

138 respondents

	N/A (not needed)	Not at all	A little	Moderate	Significant	Very significant
Insects, weeds, disease, resistance, biosecurity	1%	12%	24%	32%	27%	4%
Nutrition & soils	1%	14%	25%	30%	22%	8%
Water & moisture management, seasonal forecasting & climate	2%	16%	21%	28%	29%	4%
Energy use	5%	33%	32%	16%	12%	2%
Natural resource management	5%	36%	30%	19%	10%	0%

Suggestions for cotton industry research, development and extension

Please make any other comments or suggestions about Australian Cotton industry research, development or extension

CottonInfo and Research	They are doing some great work but may need to focus more on, on farm research rather than the lab.
	All very helpful, I have had Jon Welsh give some help re solar pumping and found him to be excellent
	Organising the herbicide resistance workshop was very informative
	Generally happy with what I see . More on soil health and nutrient cycle always good . maximizing planting date options in CQ
	Keep it going!
	CottonInfo and myBMP are two very different resources and used independently. They are not used for the same activities. Mungindi has had no CottonInfo staff involvement. Question above answered in relation to CottonInfo.
	I have answered no to the above but am aware I am accessing some of this information and resources indirectly through agronomists and other industry personnel
	Communication needs to be consistent
	I have been heavily involved with cotton info (Jon Welsh) in the economics of solar pumping on large scale irrigation pumps. I believe there is real benefits in wide scale adoption of solar pumping in many irrigation situations.
	Great resource keep chipping away and growing the content. People like Bec Fing are great. Grow the content, Grow the content, Grow the content
Weather forecasting	One day weather forecasting is good enough to influence management One week weather forecast is interesting, but apart from temperature is not accurate enough to effect management decisions. One month...just not good enough to do any real planning. By planning, I mean changing financial decisions based on a weather forecast.
Regional issues	Need more focused research in the Lachlan/Murrumbidgee on soil type variation and its relationships with nutrition - sodic soils, amelioration amounts timing etc
	Can't wait for the research to start in the UNCGA
	More varieties to suit CQ.
Disease & row spacing	Try to find a variety that will grow in the cold to help combat black root out. Further research into southern valley row spacings and plant populations Experiments on farm have demonstrated narrow rows (30 inch) have shown same yield into a shorter amount of time.
	Verticillium Wilt
	Vert wilt needs a lot of research, it is the most pressing problem I believe to the Irrigated cotton industry.
	I would like a trial on row spacing vs yield in narrow rows eg: 36inch, 30 inch cotton vs 40 inch

Participation in cotton research trials

Grower participation in research trials

Did you have any cotton industry research trials on your farm last season? (eg CRDC, CSIRO, DPI, DAF, Universities, etc)

109 respondents

As far as you know, were any of these research trials funded by CRDC?

38 respondents

If it was a field trial, approximately how many hectares did this trial cover? (ha)

37 respondents

Please indicate approximately the time and cost that you contributed to industry research trials last season.

41 respondents

35% of respondents (38 farms) indicated they had hosted cotton industry research trials on their farm last season.

Of those with trials on their farm:

42% were identified as funded by CRDC, 40% were not CRDC funded, 18% didn't know if the trials were CRDC funded.

24ha was the average size of trials

0.005 to 100ha was the range in size of trials

19hrs was contributed on average by trial co-operators to the trial work last season. Range: 0 – 100 hours.

$5,543 was on average contributed to research trials, ranging from 0 to $70,000.

94% of these trial co-operators indicated they contributed $1000 or more to the trial

29% indicated they contributed $5,000 or more to the trials.

Telecommunications services

Cotton Australia sought to gather information about telecommunications services on Australian cotton farms to assist in their policy submissions. This information is also relevant when designing research extension materials as the strength of internet connections may influence the reach of some internet based resources.

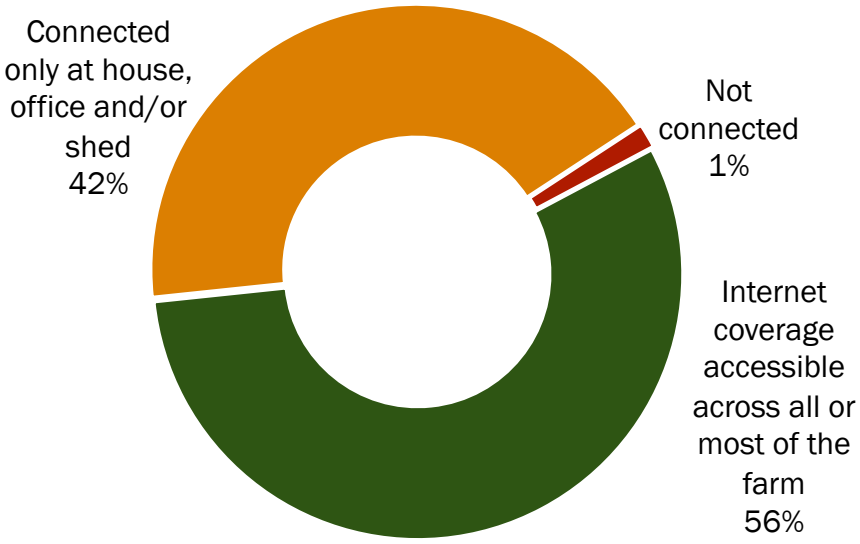
While the survey was posted in hardcopy to all farms, the majority of responses were received online, which may influence the responses here. For example, one farm made several attempts to complete the survey online but finally completed the last page (about telecommunications) on paper due to repeated internet drop-outs.

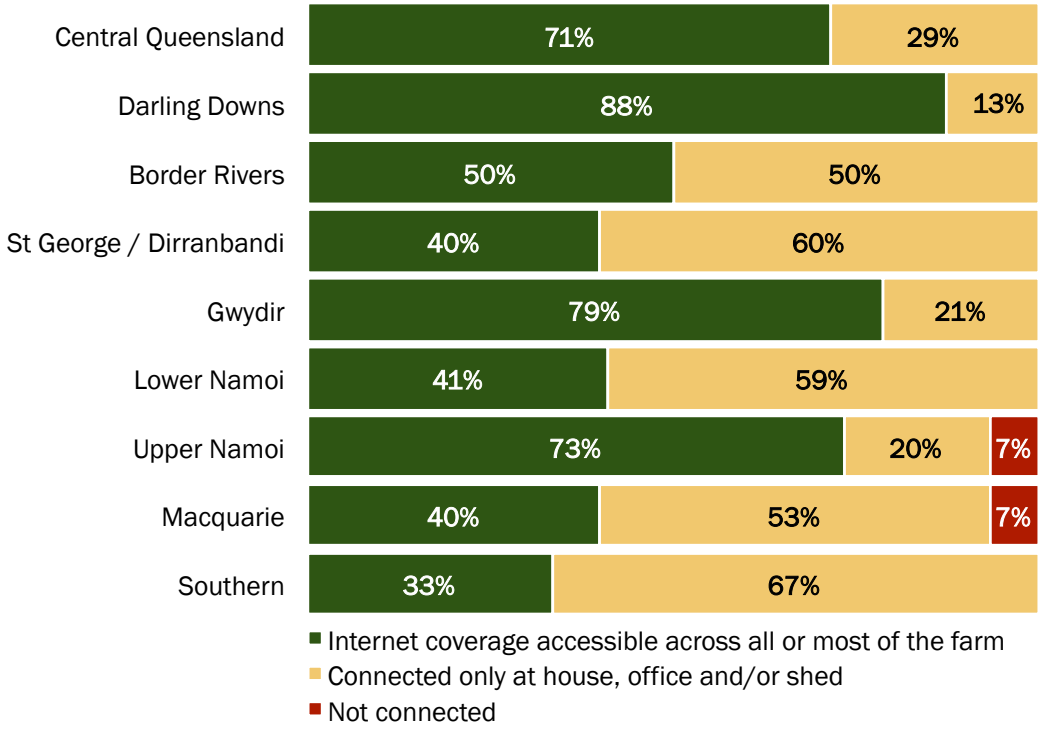
Internet connectivity on cotton farms

Which of the following best describes the internet connection at your farm?

139 respondents

99% of respondents have the internet connected

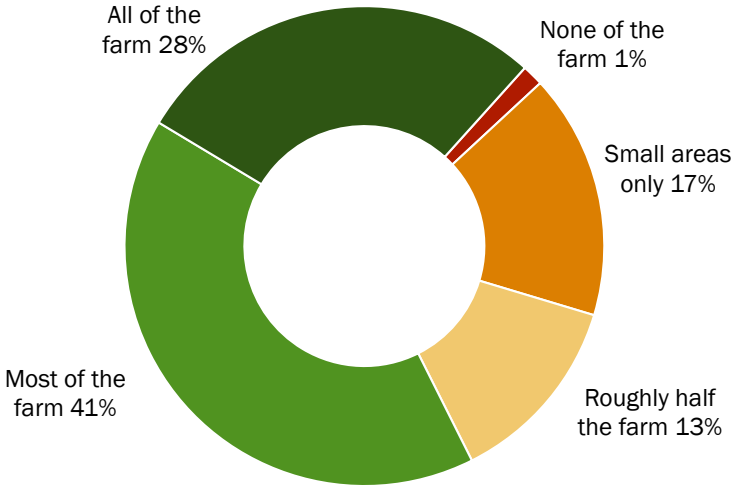


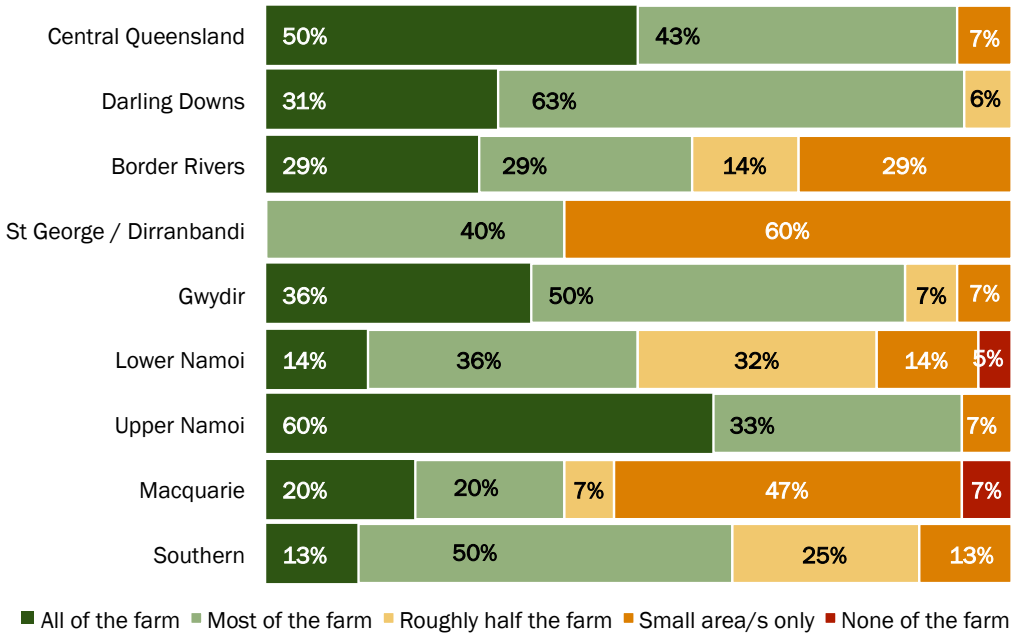


Mobile phone coverage on cotton farms

Across approximately what proportion of your farm do you have functional mobile phone reception?

139 respondents



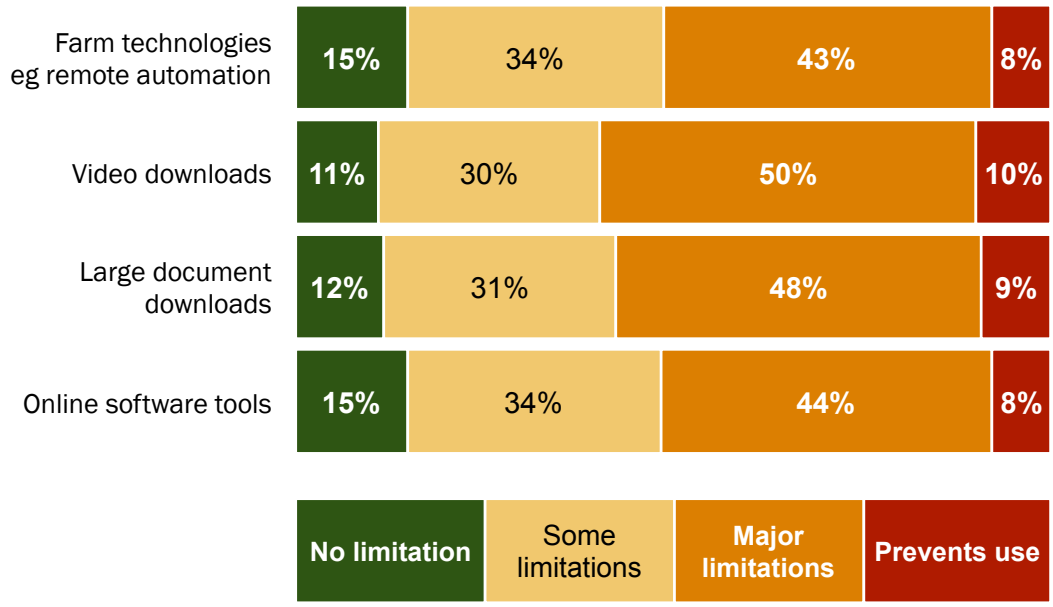


Limitations to business from internet connectivity

To what degree does internet speed, download limits, cost and/or reliability restrict your use of internet based tools or information in your business

139 respondents

68% selected 'major limitations' and /or 'prevents use' on one or more of these uses



Business limitations from internet or telephone connectivity

Please describe any limitations to your business caused by internet or telephone connectivity

67 respondents

Limitations caused by restricted telecommunications connectivity include the ability to use online software or data sharing such as accounting tools or data uploads for analysis.

For some farms this problem is so great that they have moved their farm administration to offices in town.

Reliability, speed and cost were frequently mentioned. Some had no phone reception at all or intermittent.

Individual comments follow.

Impacts

Our business needs to be conducted 30km away in town, none of our admin can be conducted at home, it's horrible
Always going back to the house to get information and remote monitoring does not work well
Webinars
Feel out of touch being left behind
We would be the same as everyone else, just worse
While the farm is mostly covered with mobile service, it is between 1 and 3 bars, which means that telemetry units such as weather stations, probes, mace meters and dam monitors don't upload as frequently (every 30mins) as they should they only update when coverage is clear enough
We are very inefficient due to time waiting for the internet to process, some programs we wish to use such as Xero, will not work
Huge limitations, phone and internet reception is basically non existent
It is a major issue that is only getting worse as updated business tools require more data and faster speeds.
The connection is there but the speed is very poor. Makes most online tools and interactive or videos unusable.
The cost is extremely high and a large part of the value is burned in failed downloads
Makes communication very difficult.
Banking issues, interrupted service, slow speeds
Don't start me. Internet cost and limited bandwidth is the single MOST important issue that is holding back the implementation of new technology in agriculture
Its a pain
Prevents us from uploading data for analysis.
Use of Cloud for accounting communication with our accountant
Internet speed is too slow to use these on line tools
Last wheat harvest our internet was affect e.g. would not work during the day, could not do internet banking
Struggle to even use Sunwater online due to poor mobile phone reception.
Data and mobile phone reception is terrible within the St George Irrigation area.
Very hard to do business at times
{Poor} communication
Very frustrating for most business. Can't use Windows 10 as unable to do updates
When using remote access to live accounting programs the internet connectivity is very slow and almost impossible to use

Reliability

The local tower and exchange is in extremely close proximity yet the dropout rate for data and calls is extremely high. Data can dropout for no reason and continue to drop at a rate of 12-18 times a day at 5-15mins each time
Internet service can be unreliable and this can cause issues when accessing information, awaiting important e mails, most suppliers are now using web and e mail based invoicing and recording, making it difficult to get information at times. Most businesses based in towns have reasonable service and they expect farmers to be able to access a computer and reliable internet at all times to interact with them and read information about products and services, even operators manuals and information
Connection drop outs for wireless internet can be frustrating especially if you need to re enter data
Can only get wi-fi internet which we only get low signal strength for. It drops out constantly and has done on four occasions while doing this survey
We live 8km from a Telstra tower, approximately 30% of the time it does not work
Major internet problems
Service
The internet connection is very poor on the farm and intermittent.
Mobile phone coverage is very intermittent - ie. have to stand on the ute roof to get reception in some spots on the farm.
Inconsistent across all areas
Slow and unreliable internet service. Only just have mobile reception in field.
Don't have the speed and internet is often down

Cost and reliability

Cost of relatively minor data amounts in relation to other schemes such as NBN
Very limited in what farm technologies we can use, continual drop outs causes major delays, the cost of relatively small data allowance - i.e. Telstra 3G $100/mth for 15GB
Cost of data to high and speed to slow
Reliability, always dropping in and out.
Very expensive for the small number of gigs
Slow!
Unreliable expensive services.
Hinders business and development of precision ag through slow, unreliable connections that cost a fortune compared to people living in towns and cities.
The cost of data via the 3G mobile network is a rip off and its slow so a lot of what we do is restricted by these limitations
Wi-fi expensive, trouble connecting (says it's connected but won't load).
Can't access at all in peak demand periods.
Spent $1800 each on 3 yogi aerials & boosters so we can speak on mobiles at office and houses.
Limited Data plans
Cost and size data allowances
Too slow, too expensive, too unreliable
[One respondent had to complete the final page of this survey on paper as the first two attempts online didn't save due to internet drop out issues]

Phone coverage

No mobile reception!!!! Obviously we are very limited
We live approximately 6 km from Moree and still experience some phone coverage issues
Poor phone coverage, seems to be getting worse.
Only reliable phone reception and data around houses with the use of antennas and CelFi boosters. The rest of the farm is has very patchy and limited service.
Unless you have a car-kit and an external aerial, we have very little coverage. can make occasional sms.
Mobile data plans relatively expensive.
poor mobile service

Solutions

Only have no limits due to setting up our own wiresless network and utilising an ADSL connection in town.
We have had to invest in a 25m tower and expensive receiver to enable better internet coverage / access
Guide us to some of the solutions - It is an important part of what we do - connectivity and remote technology to pumps etc. is only going to get better in time (not quite there yet)

Other

I started faming with a party line and manual exchange. Everything is a plus after that.
My internet (Telstra wireless with a roof aerial) is adequate for our location.
Mobile phone is good with a car aerial, hand held not so good.
Internet at farm is by 'phone "hot spot", but good internet connection in town.
Ability of me to use the technology

Other comments

Grower contribution

Any other comments or suggestions?)

8 respondents

Other comments and suggestions made were:

- Keep developing myBMP and getting growers to continuously improve governance and productivity
- Great for the industry to do these surveys - good on you for putting it out there
- Maybe sending out the survey during a quieter time would be better for high response rate
- Research station in the south
- Vert needs a lot of work doing on it.
- Any chance we can lobby for a weather station at Mitchell? Would be great to see how much rain falls there to assist in river run events!
- Thank you

Survey reporting

Reporting

Would you like to receive a copy of the survey report?

136 respondents

76% of survey respondents would like to receive the survey report.

- 54% as an email link to the report
- 8% in hard copy and
- 23% in CRDC's Spotlight magazine.

A special thank-you to all growers who have taken the time to share their information through this survey.

Australian Government

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