

Measuring Farming Practices Used on Cotton Farms

Ingrid Roth

Roth Rural, PO Box 802 Narrabri 2390, ingridroth@roth.net.au

Abstract

Agronomic management practices used on cotton farms have been monitored through surveys of growers conducted for the Cotton Research and Development Corporation (CRDC). Surveys have gathered information over several years about cotton growing practices, allowing change to be monitored over time to help inform research investment. Since 2013, data has been gathered annually on yields, fibre quality and farmer perspectives on research and extension. In addition, a series of specific agronomic themes have been investigated in detail in different years. These have included nutrition, soils, biotechnology stewardship, weed management, irrigation, energy, workforce, harvesting and riparian areas. This paper reports a small selection of findings from the 2013 and 2014 cotton grower surveys. Cotton grower responses to the 2014 survey covered 27% of the irrigated and 35% of the dryland cotton area grown in the 2013-14 season. The 2013 survey responses represented 23% of the irrigated cotton production area and 27% of the dryland cotton area in 2012-13. This paper describes the survey program and presents a small sample of findings.

Introduction

Information about farming practices and grower perspectives can help inform research and extension efforts. Over the past two decades, a range of research has gathered information on practices used in cotton growing and can be used to monitor change over time. This research for the CRDC and Cotton CRC has included:

- Surveys of cotton growers: 2013-14 (Roth Rural, in press), 2012-13 (Roth Rural, 2013), 2010-11 (GHD Hassall, 2011), 2008 (CCA et al 2008), 2006 (CCA et al, 2007) and 1996-7 (CRDC 2000).
- Annual surveys of cotton consulting agronomists undertaken by Crop Consultants Australia gathering detailed information on crop protection and other issues.
- Financial Comparative Analyses conducted annually by Boyce Chartered Accountants.
- On-farm measurements to benchmark water use efficiency (Montgomery and Wigginton 2012), disease prevalence (Kirkby et al 2013) and weed populations (Werth et al 2013).
- Focus groups to assess industry attitudes towards Integrated Pest Management (Coutts et al 2001).
- A convergent interview study on irrigation and knowledge (Callan et al 2004).

Written surveys with telephone follow up have been most effective. The 2011 survey was planned as phone interviews, with the questions mailed out in advance. It was found the majority of respondents preferred to complete the survey form and mail it back. Personal phone calls to invite participation has been essential to achieve adequate response rates.

Method

Questions for the 2013 and 2014 surveys were developed in collaboration with CRDC, Cotton Australia and researchers. In 2013, an open call was made to all cotton researchers for input. Multiple research surveys were combined into one. More recently, the CRDC's monitoring and evaluation framework has guided information needs.

Surveys have focused on the season just completed, investigating a small core of questions annually (yield, crop area, quality) and a further 3-5 themes in detail on a rotating basis. The 2013 survey investigated nutrition, soils, biotechnology stewardship, energy, harvesting, workforce and communications. The 2014 survey explored weed management, irrigation, climate, carbon and riparian areas. Relevant questions have been repeated from earlier surveys to allow data to be compared over time. The intent is to revisit these themes in future years to monitor change. To strengthen the robustness of the data some key questions were investigated over two years to overcome some of the variation in seasons and respondents. For example, information on crop nutrition data was gathered in 2006 and 2007 and revisited in 2011 and 2013.

Surveys were conducted as a written survey, distributed by both mail and email. Respondents could complete the survey on paper or into an online survey tool. Each farm enterprise registered with CRDC (1117 farms in 2014) received by post: a printed survey booklet; a cover letter from CRDC; a snapshot of previous survey data; a stamped return envelope; and a personalised quick response form for recipients to update contact details and indicate if they did not grow cotton or declined to respond. An online survey tool (C-Vent) was emailed – providing growers with an alternate response option and reaching some growers who were not registered with CRDC. This electronic survey tool was used for all data entry.

To encourage a response, industry newsletters promoted the survey and reported previous findings. A prize draw was offered as an incentive. After an initial 3-4 week response window, follow up phone calls encouraged further responses. Survey findings were communicated through reports back to respondents, excerpts in industry media and presentation at the 2014 Australian Cotton Conference.

Determining population size was a challenge as the number of farms growing cotton in any given year is not known. Not all growers registered with CRDC grew cotton in each survey year and not all growers were registered with CRDC. The survey response is considered both in relation to the number of growers registered with CRDC and the total area of cotton grown.

Findings

In 2014, surveys were returned by 177 farms (19%) covering 101,883 ha of irrigated cotton, which was 27% of the national irrigated crop and 14,394 ha, or 35% of the dryland cotton area grown in the 2013-14 season. A total of 420 responses (37%) were received by mail or phone contact, of these 177 returned the survey (124 by mail and 53 online); 144 had not grown cotton in the 2013-14 season and 31 had the survey returned by another on the farm – giving an adjusted population pool of 942 and a response rate of 19%. Regionally, the response rate ranged from 13% in Central Queensland to 21% in Southern NSW. In 2013, 165 surveys were completed, covering 23% of the irrigated cotton area and 27% of the dryland cotton area in 2012-13.

Data rich questions (eg nutrient rates) have required considerable checking to ensure accuracy. The most common inaccuracies have been fertiliser rates recorded in place of nutrient rates and ‘per hectare’ measures recorded as ‘per acre’. These were corrected where possible by calling the respondent.

Yields and quality

Cotton yields in most regions in 2014 were lower than 2013. An exception was Central Queensland where, with relatively dry, sunny conditions, substantially higher yields were achieved in 2014 than in previous wet, cloudy years. In both years there is a substantial difference between the average yield across the region and the highest yielding field recorded for the region, as illustrated in Figure 1 for the 2013-2014 season. The highest yield recorded for a field in the 2014 survey of 15.6 bales/ha was 5.8 bales/ha higher than the average yield across all regions.

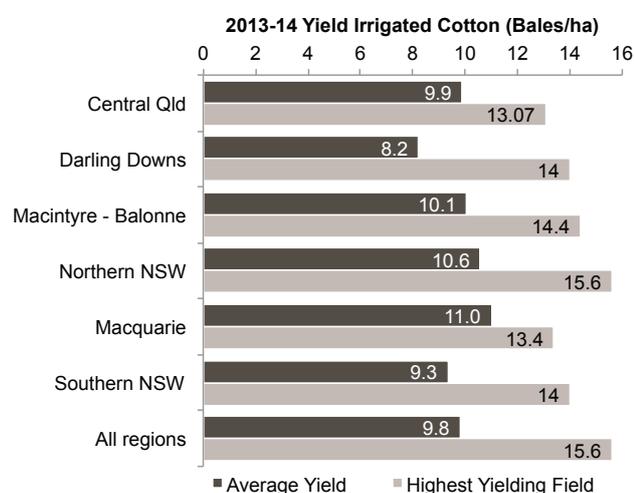


Figure 1 Average and highest yields of irrigated cotton 2013-14

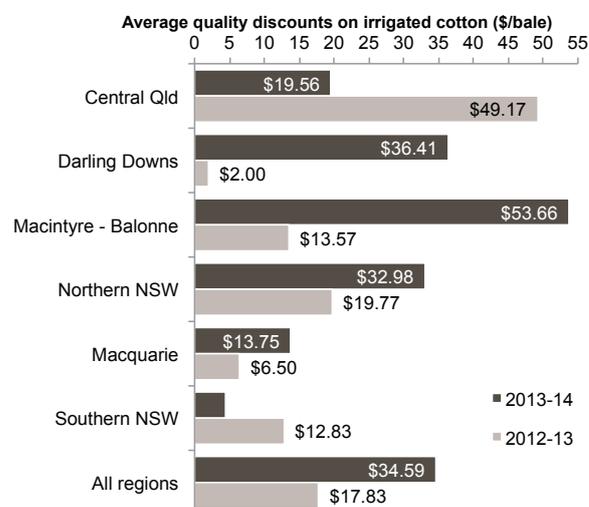


Figure 2 Average quality discounts recorded by region in 2012-13 and 2013-14

Cotton fibre quality is influenced predominantly by weather conditions and insect damage. Figure 2 compares the level of quality discounts reported from the 2012-13 season (dry harvest in most regions, wet in Central Queensland) to the 2013-14 season (wet harvest most regions, dry harvest in Central Queensland). Within regions, some significant differences have been observed in the level of quality discounts recorded on different farms, with potentially large implications for profitability.

Nutrition

Nutrient rates as applied fertiliser were gathered using similar categories to previous years, allowing the rate of applied nutrients to be compared from 1997 – 2013 (Table 1). The overall increase over time can likely be largely attributed to increases in cotton yields. However, the high variability in rates used on different farms in 2013 was not correlated with yield. 29% of respondent farms applied between 200-250 kgN/ha and 27% applied more than 250 kgN/ha. The most commonly given reasons for higher nitrogen rates were “the crop needs more N to achieve high yield” (75% of respondents) and “the agronomist recommended it” (41%). In 2013, 13% of respondents achieved a nitrogen fertiliser use efficiency within the optimum range of 12.5 to 16 kgLint/kgN recommended by research.

The 2013 survey also gathered information on timing and method of fertiliser application, the use of soil testing and other decision factors. On average, 67% of nitrogen is applied pre-season with 50% of farms applying between 30 and 70% of nitrogen pre-season. A diversity of application methods were used.

Table 1. Nutrient rates in fertiliser applied to irrigated (IRR) and dryland (DRY) cotton, 1997-2013

FERTILISER	1997	2001*	2006*	2007*	2011 [^] IRR	2013 IRR	2011 [^] DRY	2013 DRY
Pre-season nitrogen - solid (kg N/ha)		80	87	101	142	135	89	89
Pre-season nitrogen - gaseous (kg N/ha)		78	71	60	155	169	84	70
In-season nitrogen – solid (kg N/ha)		17	29	60	99	100	45	33
In-season nitrogen – gaseous (kg N/ha)		8	14	18	83	88	40	-
In-season N water applied (kg N/ha)					57	61	5	-
TOTAL applied N kg/ha	125	176			217	243	96	84
Pre-season phosphorus (kg P/ha)		23	30	35	42	31	14	14
In-season phosphorus (kg P/ha)		2	3	2	20	15	13	8
TOTAL applied P kg/ha					40	31	16	13
Pre-season potassium (kg K/ha)		8	16	24	33	26	7	10
In-season potassium (kg K/ha)		0	2	4	15	12	2	-
TOTAL applied K kg/ha					28	24	7	10
Zinc (kg Zn/ha)		5	5	5	4.4	3	3.7	1.8
Sulphur (kg S/ha)					6.3	14	2.4	5.5
Trace elements					21	9	4	-

* 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.

Weed management

Glyphosate management to minimise herbicide resistance is a key focus of cotton research and extension efforts in the area of weed management. To coincide with the release of the first Cotton Herbicide Resistance Management Strategy (HRMS), the 2014 survey gathered information to benchmark current weed management practices. Questions were asked about the weed management tactics used in a given irrigated and/or dryland field over a 12 month period. Analysis of individual responses determined the mix of weed control tactics used to compare with the HRMS recommendations.

79% of respondents were consistent with the HRM recommendations, using two or more non-glyphosate tactics to manage weeds in an irrigated cotton field from July 2013 - June 2014. 4% of respondents used only glyphosate. In dryland cotton, 63% of respondents used two or more non-glyphosate tactics to manage weeds while 7% used only glyphosate. 73% of all respondents indicated they would tolerate less than 5% weed survivors after the first over the top glyphosate application on Roundup Ready™ cotton.

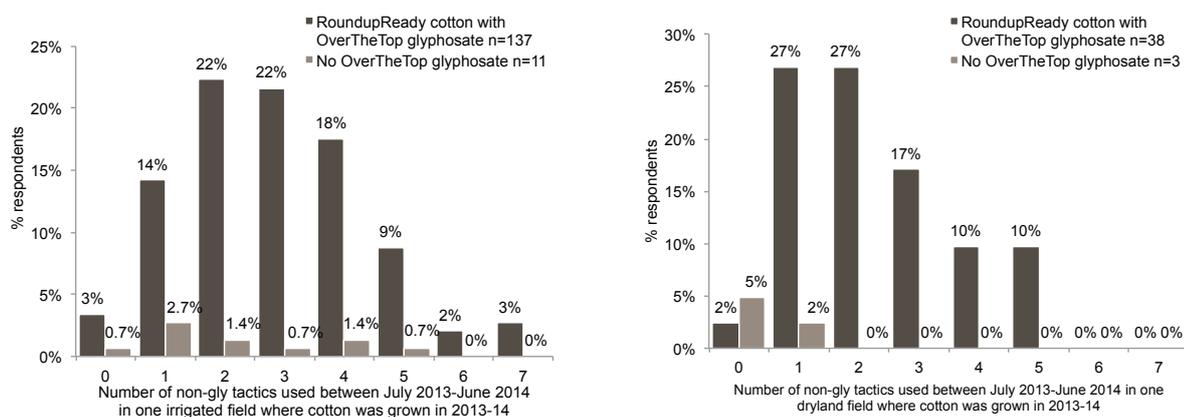


Figure 2. Proportion of farms using the number of non-glyphosate tactics to manage weeds in a irrigated cotton (left) or dryland cotton (right) field for the 12 months from July 2013-June 2014

Irrigation

From 2006 to 2011 there was a 30% increase in the use of soil moisture probes for irrigation scheduling. The use of irrigation scheduling tools showed little change between 2011 and 2014. 28% of respondents in 2014 indicated they had more than one type irrigation system on their farm. Furrow is the dominant irrigation system, with 8% of the cotton area grown under other irrigation systems in 2013-14. Table 2 shows that while 19% of respondents had lateral move irrigators, just 3% of the irrigated crop was grown under lateral moves.

Table 2 Irrigation systems used on cotton farms in 2013-14

	Furrow (excluding bankless)	Bankless Channels	Centre Pivot	Lateral Move	Drip
% respondents using this irrigation type	95 %	11 %	16 %	19 %	8 %
% of cotton area grown under system 2013-14	92.1 %	2.5 %	1.7 %	3 %	0.7 %

Conclusions

Regular surveys of cotton growers have gathered information about a range of farming practices. The information can be used to identify areas for extension effort and the industry has used the information in policy activities and for the Cotton Industry Sustainability Report. Future surveys can build on the data set.

Acknowledgments

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References

- Boyce Chartered Accountants (2014) Australian Cotton Comparative Analysis: 2013 Crop. CRDC.
- Callan VJ, Christiansen IH, Harris GA (2004) Knowledge Management in Cotton and Grain Irrigation. Australian Cotton CRC.
- Cotton Consultants Australia, Doyle B and Coleman M (2007) The 2006 Cotton Grower Survey Benchmarking / BMP Land and Water Report. Cotton CRC and CRDC.
- Cotton Consultants Australia & Western Research Institute (2008) Grower Feedback Report. Cotton CRC.
- Coutts J, Christiansen I, Cotton Extension Network (2001) 'Changes in Attitudes to Integrated Pest Management in the Cotton Industry: 1997-2001 and Attitudes to Area Wide Management.' Cotton CRC.
- GHD Hassall, Roth IH & Cotton CRC (2011) Cotton Grower Practices 2011 Survey: A survey of selected cotton farming practices and grower views across the industry 2010-11 season. Cotton CRC.
- Greenmount Press (2014) Cotton Yearbook. The Australian Cottongrower.
- Inglis G and Shaw G (2000) Cotton Industry Benchmark Survey. CRDC
- Kirkby KA, Lonergan PA and Allen SJ (2013) Three decades of cotton disease surveys in NSW, Australia. *Crop and Pasture Science* 64(8) 774-779
- Montgomery J and Wigginton D (2012) Benchmarking WUE in the Australian cotton industry. *in The Australian cotton water story: a decade of Research and Development 2002-2012.* Cotton CRC.
- Roth Rural (2013) Cotton Growing Practices 2013: Findings of CRDC's survey of cotton growers. CRDC.
- Werth J, Boucher L, Thornby D, Walker S, Charles G (2013) Changes in weed species since the introduction of glyphosate-resistant cotton. *Crop and Pasture Science* 64, 791-798