CRDC
COTTON RESEARCH AND DEVELOPMENT CORPORATION

CROP CONSULTANTS AUSTRALIA

QUALITATIVE REPORT

on the 2018-19 cotton season:
A survey of consultants

RUTH REDFERN

CONTENTS

PURPOSE

The Cotton Research and Development Corporation (CRDC) commissions this survey each year to provide current and longitudinal knowledge of on-farm practices and attitudes, to aid the research, development and extension effort within the Australian cotton industry.

COVERAGE

Data was collected by Crop Consultants Australia Inc. (CCA) from 58 cotton consultants, who answered most or all of the questions about their own practices and attitudes, as well as those of their grower clients.

The consultants represented 494 cotton growers and covered 155,287 hectares: 41% of the Australia cotton production area for the 2018-19 season (not adjusted for row spacing). This is based on the 2018-19 production figure of 379,310 hectares (Cotton Australia).

METHODOLOGY

The survey consisted of 57 quantitative and qualitative questions, which sought to draw out both the details of actual agronomic practices and consultants' views of those practices. It was conducted from May to August 2019, with questions referring to the 2018-19 cotton season. Questions that collected data on clients or areas were only made available to one participant from a consultancy to avoid duplication.

DATA COLLATION

The online Cvent survey program (www.cvent.com) was used to compile the data. Interpretations are up to the user. An asterisk indicates questions that are recurrent over time to identify trends.

ACKNOWLEDGMENT

Thank you to the consultants who took the time and effort to complete this survey. The data in this survey provides valuable information for researchers and industry organisations in planning and carrying out projects. Thank you to Crop Consultants Australia and Black Canvas graphic design for the compilation of this report.

DISCLAIMER

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THE CONSULTANTS AND THEIR CLIENTS

ABOUT THE CONSULTANTS

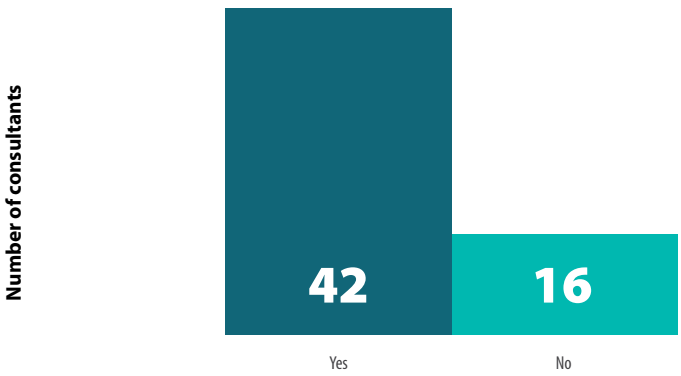
1

Are you completing the survey on behalf of the business or business unit? *

58 respondents

Note 42 consultants completed the survey on behalf of their business or business unit, which involved completing the specific questions relating to staff, hectares and clients. 16 consultants completed the survey questions only relating to individual practices and attitudes.

PRIMARY BUSINESS PERSON COMPLETING SURVEY



2

Which of the following best describes your employment as a consultant? *

58 respondents

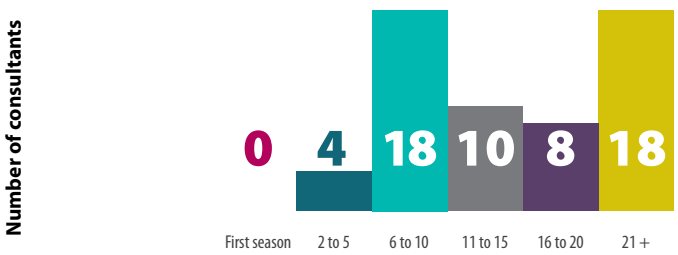
NATURE OF CONSULTANCY

3

For how many seasons have you worked consulting in cotton? *

58 respondents

NUMBER OF SEASONS CONSULTING IN COTTON



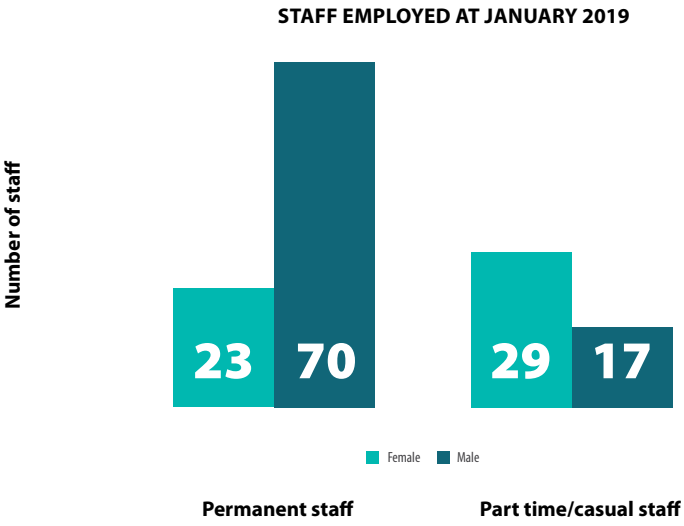
THE CONSULTANTS AND THEIR CLIENTS

4 **5**

How many and what was the gender diversity of staff employed in your business to service cotton clients in January 2019?

42 respondents relating to Permanent staff

37 respondents relating to part time/casual staff



6

With reference to recruitment for the 2018-19 season, how hard was it to find suitable applicants and fill positions?

41 respondents

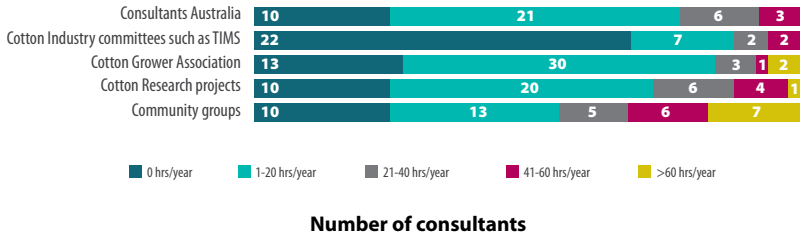
THE CONSULTANTS AND THEIR CLIENTS

7

How many hours per year do you contribute voluntarily to cotton-related and community groups?

57 respondents

TIME VOLUNTEERING TO COTTON-RELATED AND COMMUNITY GROUPS

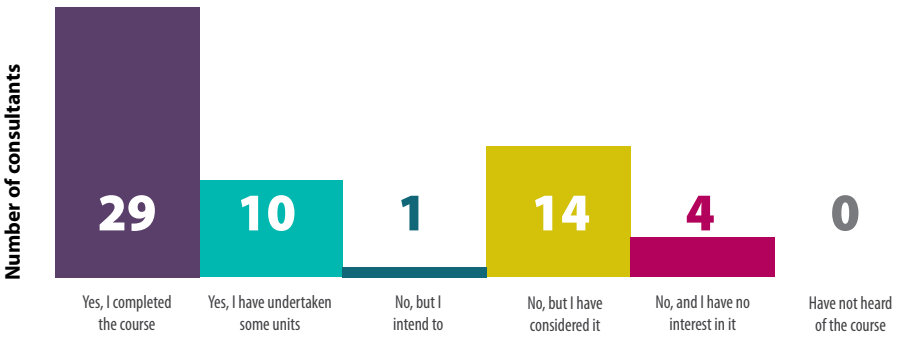


8

Have you ever had any involvement in the industry supported cotton course taught at the University of New England?

58 respondents

INVOLVEMENT IN THE UNE COTTON COURSE



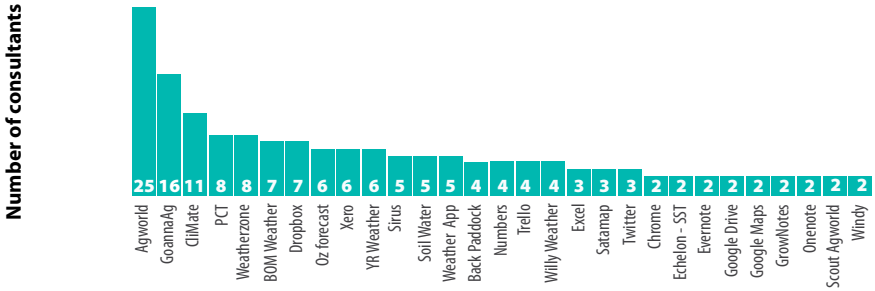
THE CONSULTANTS AND THEIR CLIENTS

9

If you use Apps on your mobile device, please list your favourite Apps (for either work or personal use).

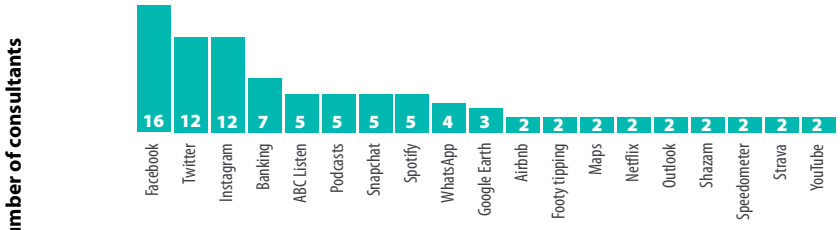
53 respondents

MOST POPULAR WORK APPS



Total Work Apps – 87 Apps

MOST POPULAR PERSONAL APPS



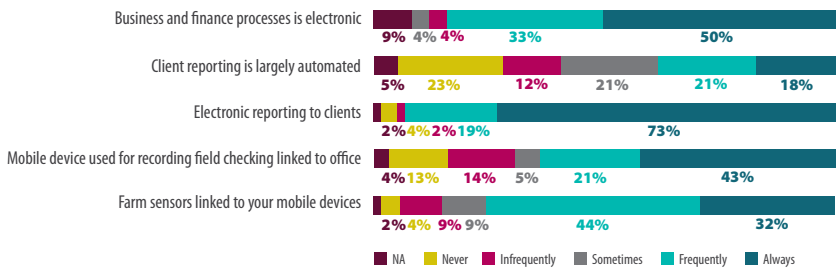
Total Personal Apps – 58 Apps

10

To what degree are you using electronic and digital technology?

58 respondents

EXTENT OF ELECTRONIC AND DIGITAL TECHNOLOGY USE



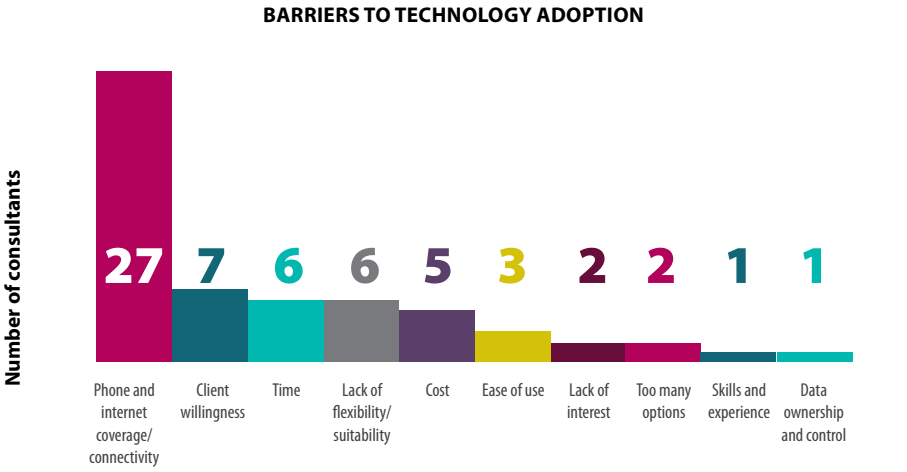
Percentage of responses

THE CONSULTANTS AND THEIR CLIENTS

11

What is the biggest barrier to you increasing adoption of digital technology?

55 respondents



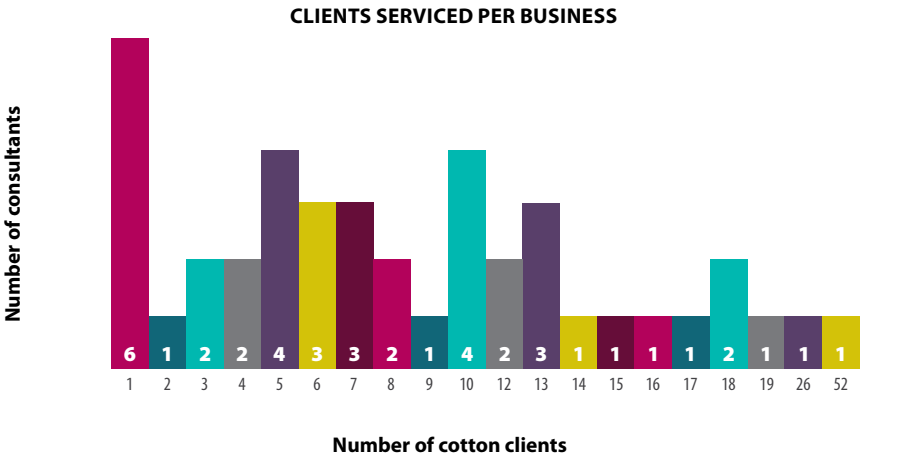
ABOUT THE CLIENTS

12

How many cotton clients did the business (or business unit) service in 2018-19? *

42 respondents

Note A total of 404 clients were represented in the survey.

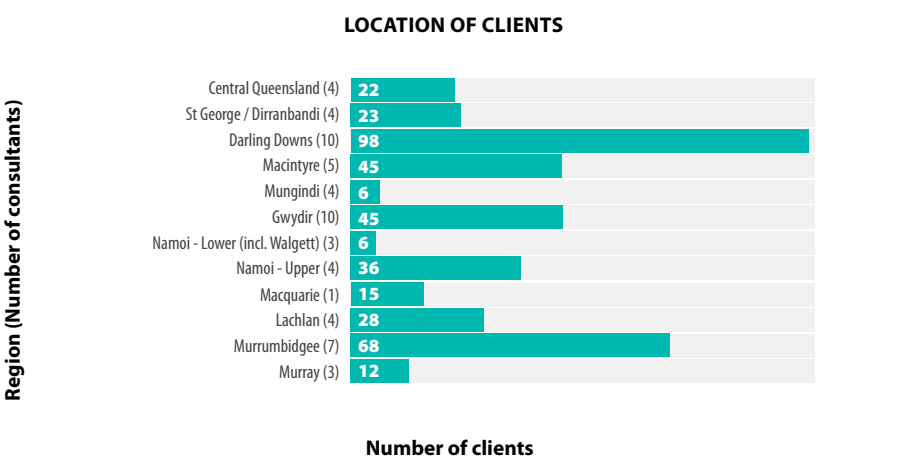


13

In which region/s are your cotton clients based? *

42 respondents

Note Some consultants have clients in more than one region, hence the total number of consultants is higher than the 42 respondents across the regions.

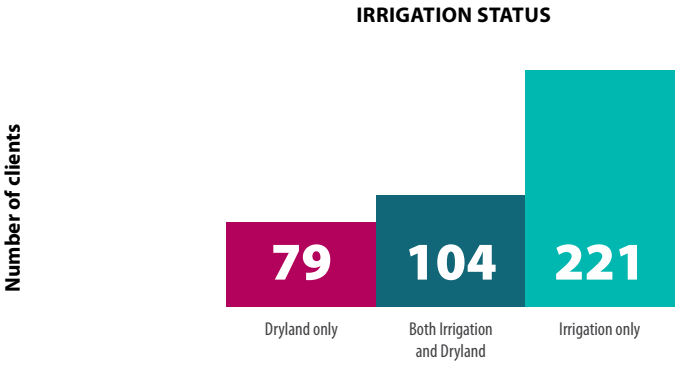


ON-FARM PRACTICES AND ATTITUDES

14

How many of your cotton clients have dryland only, irrigation only, or both dryland and irrigation? *

42 respondents



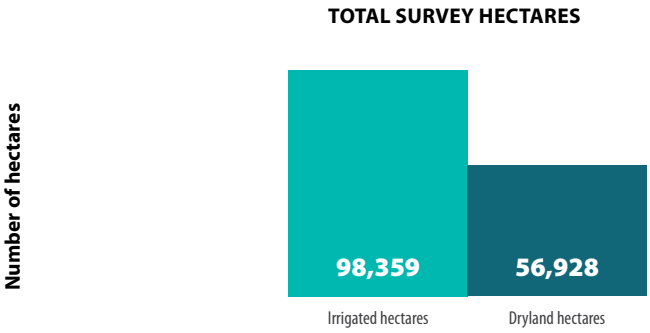
COVERAGE

15

How many hectares of cotton (total area, not adjusted for row spacing) did your clients grow in the 2018-19 season? *

42 respondents

Note Clients grew of total of 155,287 hectares of which 98,539 were irrigated and 56,928 were dryland.



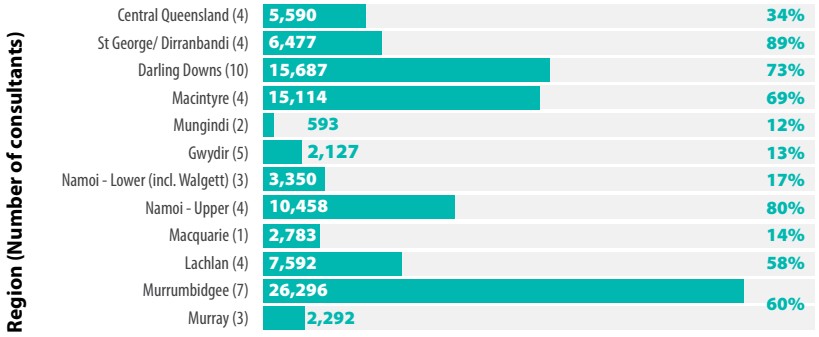
ON-FARM PRACTICES AND ATTITUDES

16

In which region/s are the irrigated cotton hectares of your clients situated? *

48 respondents

IRRIGATED COTTON HECTARES BY REGION



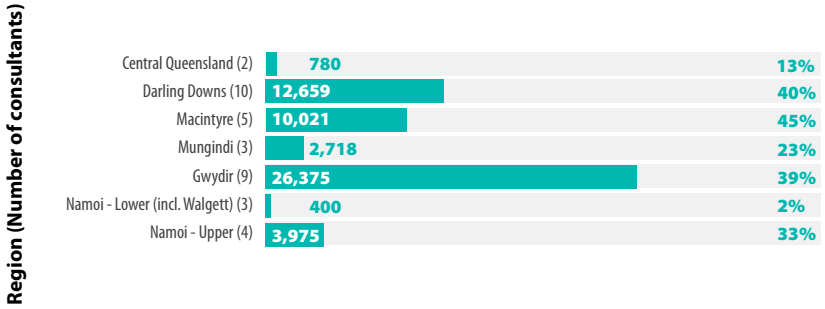
Number of hectares / Percentage of total irrigated cotton area per region

17

In which region/s are the dryland cotton hectares of your clients situated? *

33 respondents

DRYLAND COTTON HECTARES BY REGION



Number of hectares / Percentage of total dryland cotton area per region

ON-FARM PRACTICES AND ATTITUDES

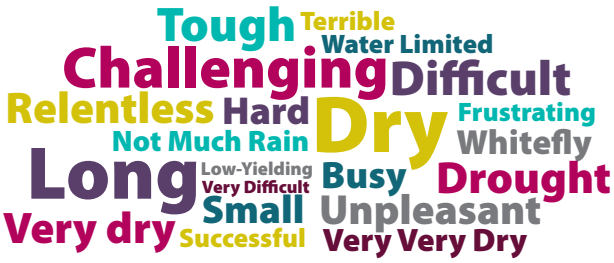
2018-19 SEASON

18

Describe the 2018-19 cotton season in three words or less.

63 respondents

This was an open question. Please see the appendix for full individual responses.

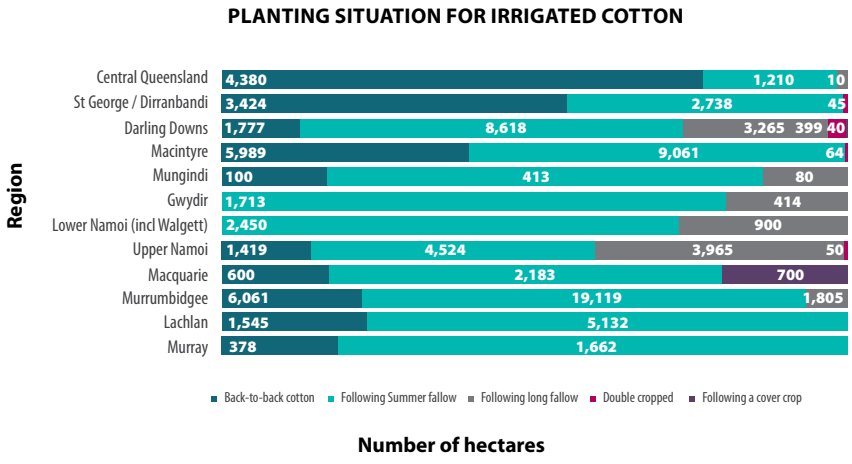


PLANTING

19

Of your irrigated cotton hectares in 2018-19, how many were back-to-back cotton, following summer fallow, following long fallow, double cropped, or following a cover crop? *

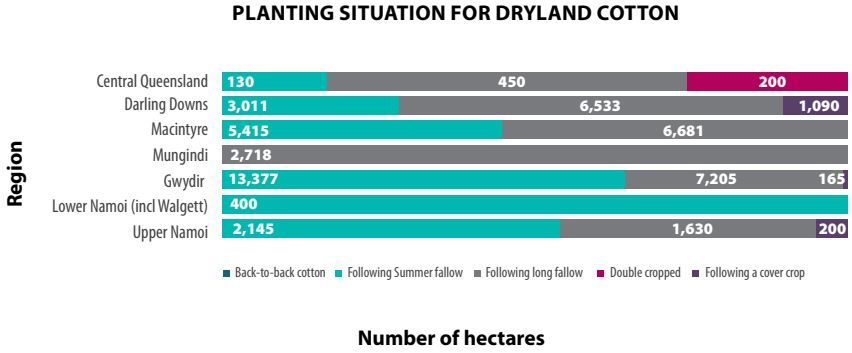
38 respondents



20

Of your dryland cotton hectares in 2018-19, how many were back-to-back cotton, following summer fallow, following long fallow, double cropped, or following a cover crop? *

31 respondents



ON-FARM PRACTICES AND ATTITUDES

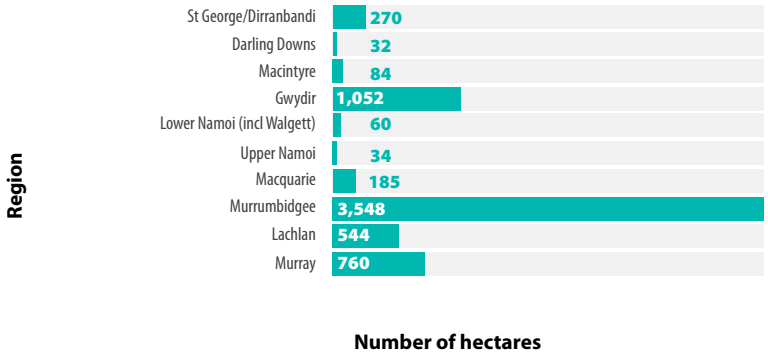
21

Of your irrigated cotton hectares in 2018-19, how many were new fields or first time cotton, i.e. never had cotton grown there previously?

37 respondents

In total, 6,569 hectares of irrigated cotton were planted in new fields.

NEW IRRIGATED COTTON FIELDS (NO PREVIOUS COTTON)



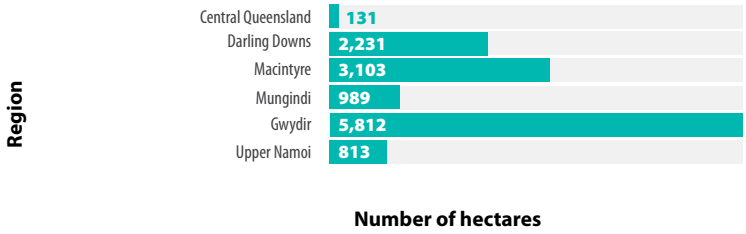
22

Of the dryland cotton hectares, how many were planted in new fields, i.e. never had cotton grown there previously?

27 respondents

In total, 13,079 hectares of dryland cotton were planted in new fields.

NEW DRYLAND COTTON FIELDS (NO PREVIOUS COTTON)

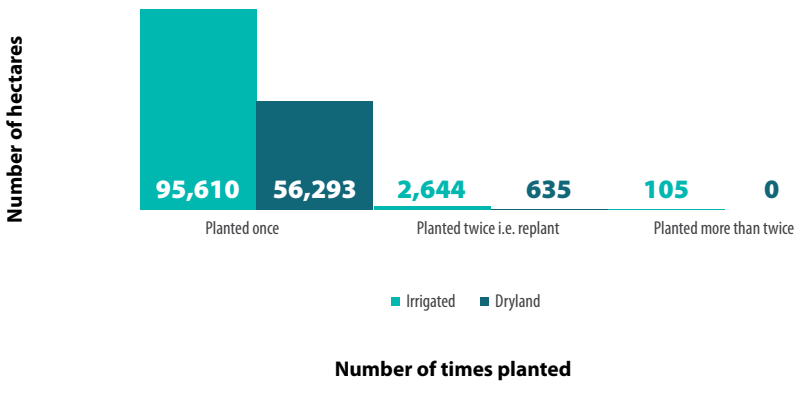


23

Of the irrigated and dryland cotton hectares, how many were planted once, planted twice or more than twice? *

38 respondents

REPLANTED HECTARES



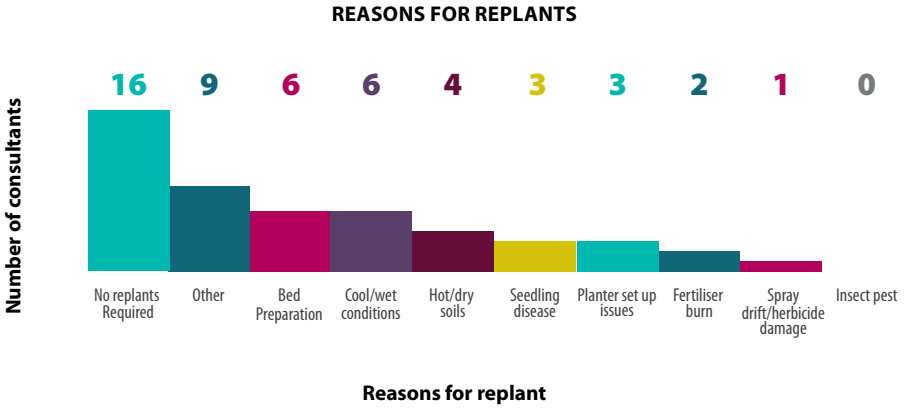
ON-FARM PRACTICES AND ATTITUDES

24

Select the reason/s why replants were required (select multiple as required)*

39 respondents

Note Other responses included: sand blasting (3), crusting following rain (2), hail, waterlogging, variable moisture, subbing issues and sodicity, poor seed vigour, residual herbicide damage.

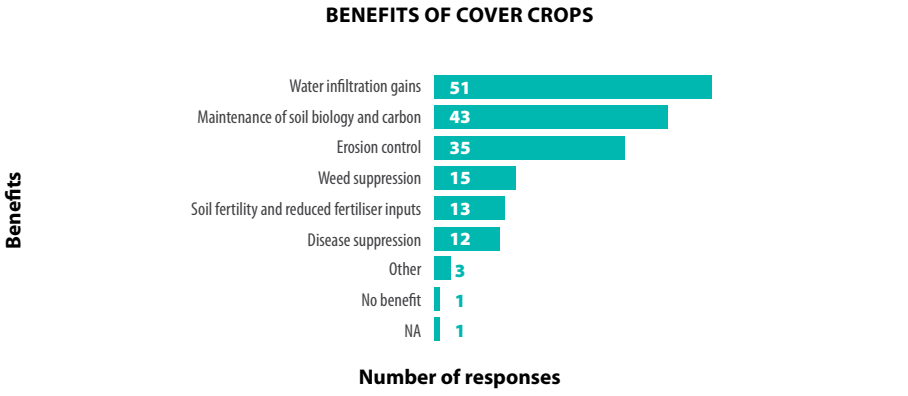


CROPPING PRACTICES

25

What do you see as the main benefits for growing a cover crop?

58 respondents

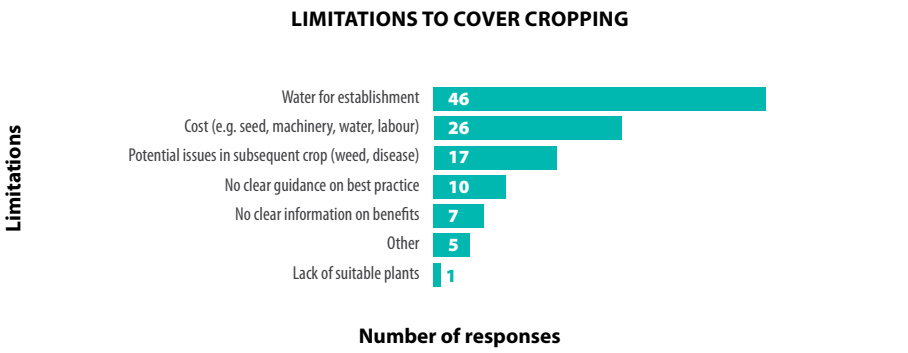


26

What is the biggest limitation to cover cropping?

57 respondents

Note 'Other' responses included: Farmer interest and ability; not enough data; opportunities to get nutrition onto the next crop without disturbing the double crop; soil moisture for in crop use; the profitability of the strategy in opportunity farming system where moisture could be limited for cash cropping and seasonal variations are significant.



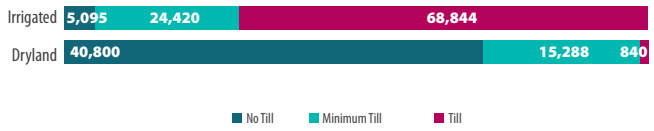
ON-FARM PRACTICES AND ATTITUDES

27

Of the irrigated and dryland cotton hectares, how widespread in 2018–19 was the use of reduced tillage practices by your cotton clients?

37 respondents

REDUCED TILLAGE PRACTICES



Number of hectares as percentage of total survey hectares

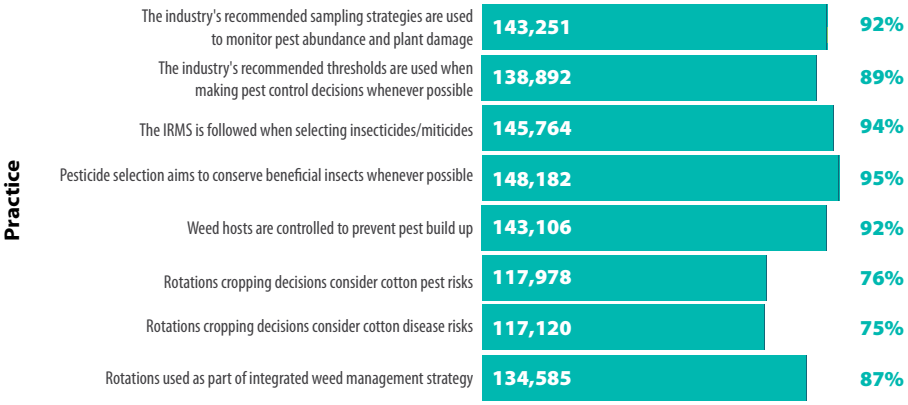
CROP PROTECTION

28

With regards to insect pest management in 2018-19 cotton fields, how widely used (in terms of total irrigated and dryland hectares) were the practices listed. *

42 respondents

EXTENT OF INSECT PEST MANAGEMENT PRACTICES



Number of hectares / Percentage of total survey hectares

ON-FARM PRACTICES AND ATTITUDES

29

Are there any pests (insect, weeds, diseases) or situations where a lack of product registration is limiting your ability to provide advice?

39 respondents

Alternaria early season.

Alternaria, Sclerotinia, Black Root Rot.

Barnyard grass in crop, getting extremely hard to kill.

Black Oats in winter cereals.

Black Root Rot, Alternaria, Boll Rot.

Black Root Rot, Fleabane, Alternaria, soft cheap Mirid control.

Black Root Rot.

Black Root Rot. Selective early season residual OTT (2-4 leaf) thrip insecticide.

Cotton Stainer.

Diuron in winter fallow.

Feathertop Rhodes Grass, Tar Vine, Fusarium.

Feathertop Rhodes Grass.

Harm to Bees is an issue.

Lack of product registration for Sclerotinia has been an issue in the past. Also had issues with lack of registration which limited Black Root Rot disease trials this season.

Lack of soft options on pests such as Green Vegetable Bug and Cotton Stainers can be problematic some years and on some farms. Disease front - yes more permits/registrations needed.

Low rates, below 62.5mls/ha for Regent. Or low rates with salt for any insecticide. This needs to be sorted for legal liability reasons.

Mealybug, Feathertop Rhodes Grass.

Mealybug.

Mealybug. Defoliation - Diuron addition to Dropp Liquid (Cost of UltraMax).

Mirids - lack of truly soft options.

More data on Buprofezin in Mealybug.

More WeedIT registrations required for fallow weed control.

No x 7

Not sure why the rates of some Silverleaf Whitefly insecticides are higher in Arizonia as compared to Australia, e.g. pyriproxyfen, and is this impacting upon the level of control being achieved with these products? Do the registered rates need to be increased, either on the label or via a permit?

Rates in Whitefly registrations.

Rhizoctonia, Verticillium Wilt, Sclerotinia in cotton, Green Vegetable Bug, Rutherglen Bug.

Roundup resistant Barnyard Grass and Liverseed Grass.

Soft options for Green Vegetable Bug and other shield beetles. Persistent control of thrips when being inundated from senescent cereals.

Still Silverleaf Whitefly. Buprofezin registration will help here.

Suitable option as a replacement to Fipronil that is reliable, every other product on the market for mirid control has issues.

Verticillium Wilt, Fusarium Wilt, Black Mould from wet weather prior to picking.

Verticillium Wilt.

Whitefly - Admiral resistance is of concern. Mirids - what happened to the fungus that Robert Mensah developed? General comment - if we get a late break and the cotton area increases significantly product supply will be a problem.

ON-FARM PRACTICES AND ATTITUDES

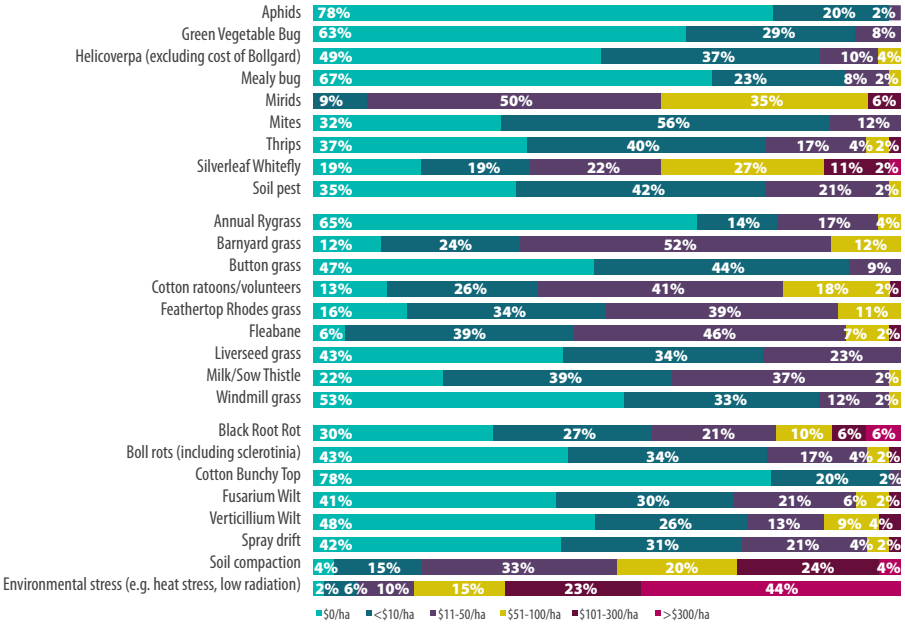
YIELD IMPACTS

30

Rate the average impacts you think the following pests, weeds, diseases and disorders had on the profitability of your clients' cotton crops in 2018-19, either through budgeted or unbudgeted costs or through yield loss. *

56 respondents

ESTIMATED IMPACT OF INSECTS, WEEDS, DISEASES/DISORDERS



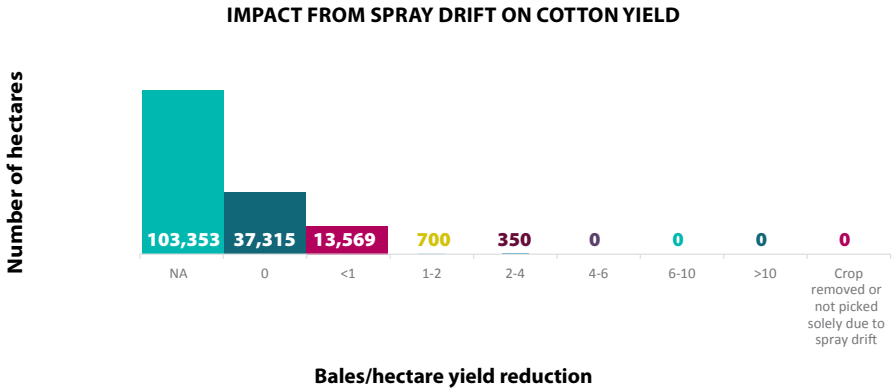
Percentage of responses

ON-FARM PRACTICES AND ATTITUDES

31

What yield impacts do you estimate spray drift had on your clients' cotton crops this season? Please indicate your best estimate. *

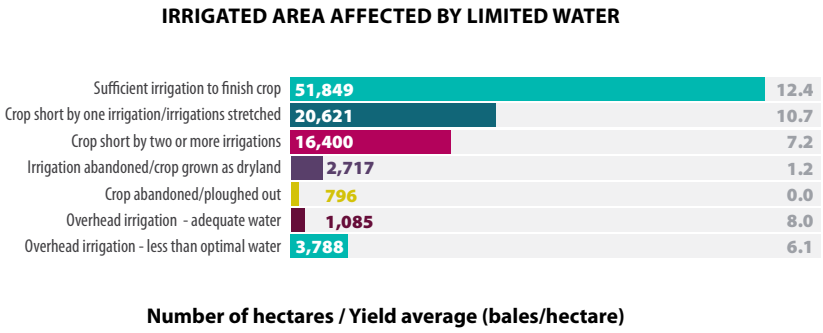
42 respondents



32

For the irrigated cotton hectares over which you consulted, how much area in 2018-19 season was affected by limited water? Please also indicate your best estimates of yield in each situation. *

38 respondents



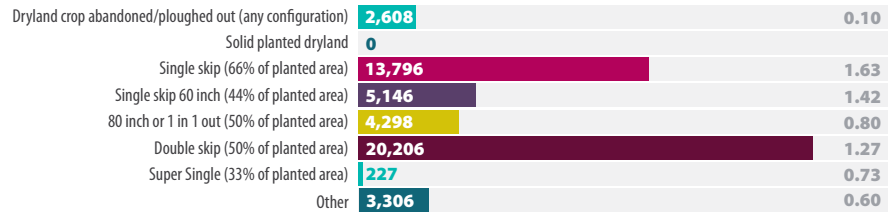
ON-FARM PRACTICES AND ATTITUDES

33

For the dryland cotton hectares over which you consulted, please indicate your best estimate of yield for each situation. *

27 respondents

DRYLAND COTTON YIELDS



Number of hectares / Yield average (bales/hectare)

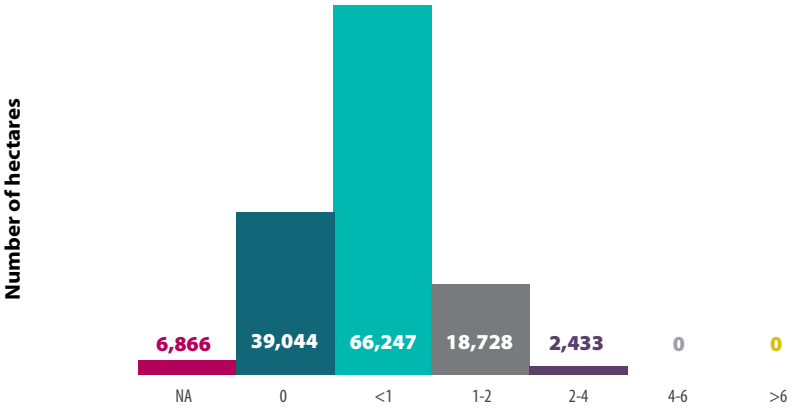
34

What impacts do you estimate compaction had on your clients' cotton yields this season? *

Please indicate your best estimate of total hectares for your irrigated and dryland cotton.

48 respondents

COMPACTION IMPACTS ON YIELD



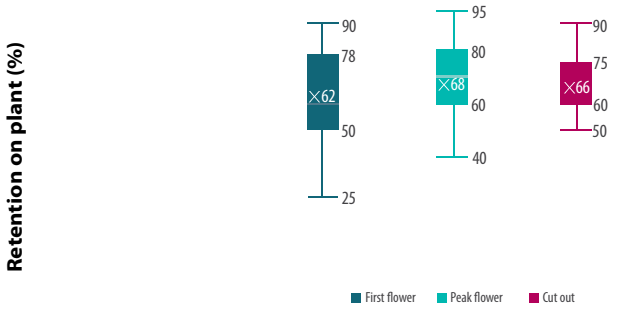
Bales/hectare yield reduction

35

In your experience what level of retention would correspond with unacceptable yield loss or maturity delay?

54 respondents

RETENTION LEVEL FOR UNACCEPTABLE FRUIT LOSS



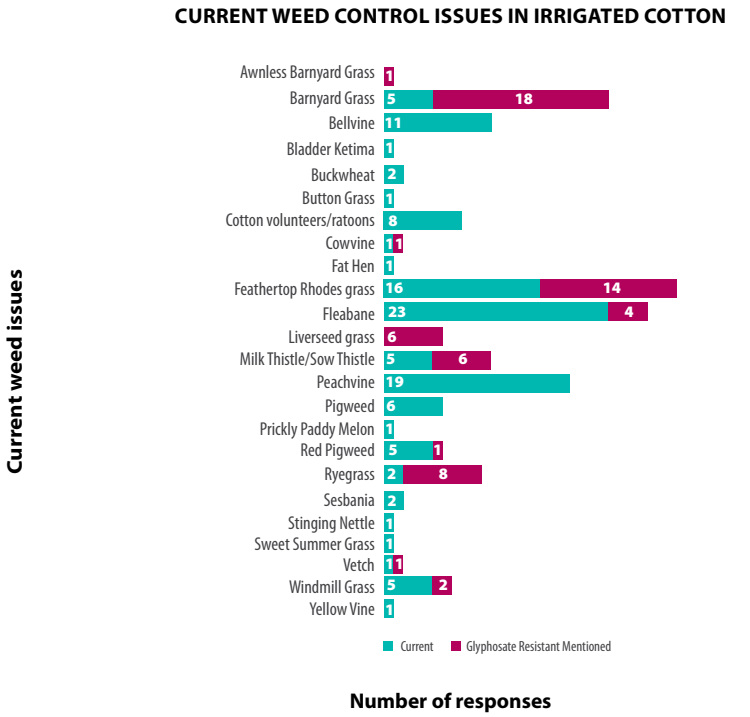
ON-FARM PRACTICES AND ATTITUDES

WEEDS

36

In your experience what weed species are CURRENTLY the biggest challenge to control in the IRRIGATED system? Please indicate where you think resistance is a contributing factor.

53 respondents

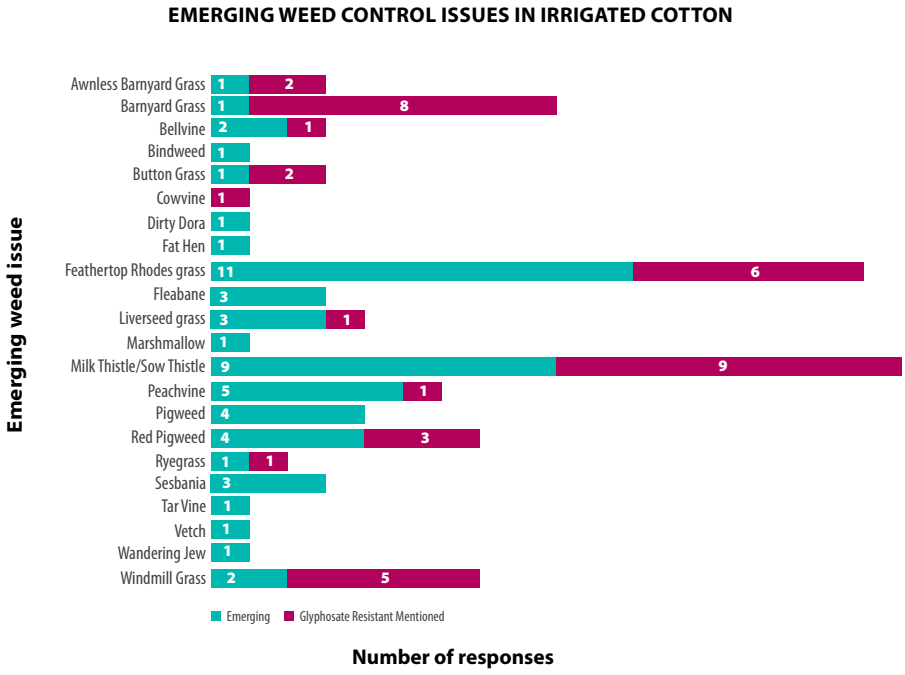


ON-FARM PRACTICES AND ATTITUDES

37

In your experience what weed species are EMERGING or likely to become difficult to control in the IRRIGATED system? Please indicate where you think resistance will be a contributing factor.

50 respondents

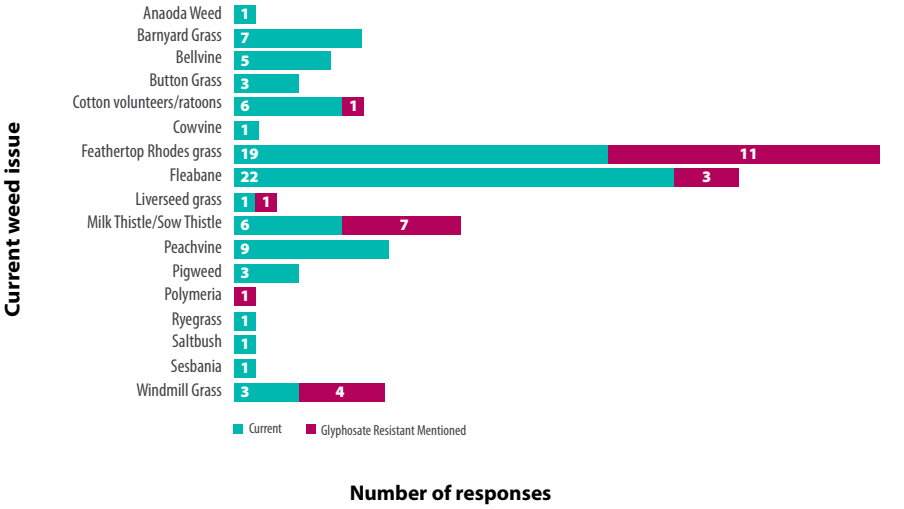


38

In your experience what weed species are CURRENTLY the biggest challenge to control in the DRYLAND system?

Please indicate where you think resistance is a contributing factor.

48 respondents



ON-FARM PRACTICES AND ATTITUDES

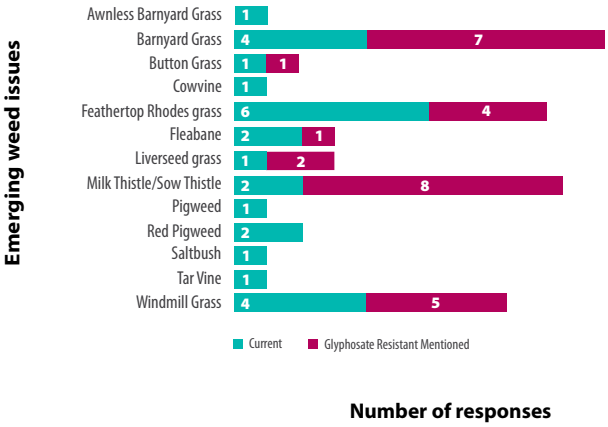
39

In your experience what weed species are EMERGING or likely to become difficult to control in the DRYLAND system?

Please indicate where you think resistance will be a contributing factor.

43 respondents

EMERGING WEED CONTROL ISSUES IN DRYLAND COTTON

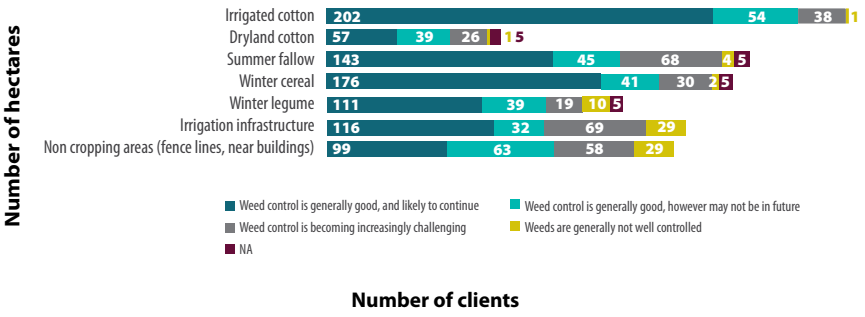


40

Thinking about your cotton clients, and how they have managed weeds across their cotton farming system, for each of the following situations, please indicate how many of your clients align with each of the following statement.

40 respondents

WEED MANAGEMENT



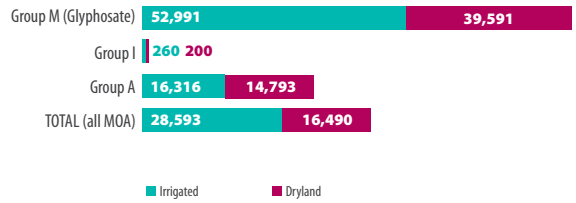
ON-FARM PRACTICES AND ATTITUDES

41

Of the irrigated and dryland cotton hectares over which you consulted in 2018-19, what is the total area (suspected or confirmed) for each mode of action, and the total area with herbicide resistant weeds?

40 respondents

AREA WITH HERBICIDE RESISTANT WEEDS



42

How many of your cotton clients have had herbicide resistance confirmed?

40 respondents

CLIENTS WITH HERBICIDE RESISTANT WEEDS

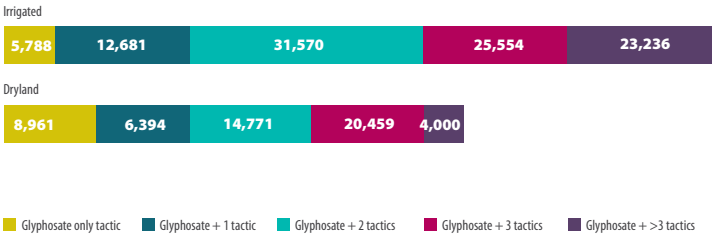
Number of clients

43

Of the irrigated and dryland cotton hectares over which you consulted in 2018-19, please estimate how many tactics were used for the cotton crop, including in preparation. For this question a tactic is considered a weed control operation such as cultivation, herbicide, chipping.

40 respondents

WEED CONTROL TACTICS



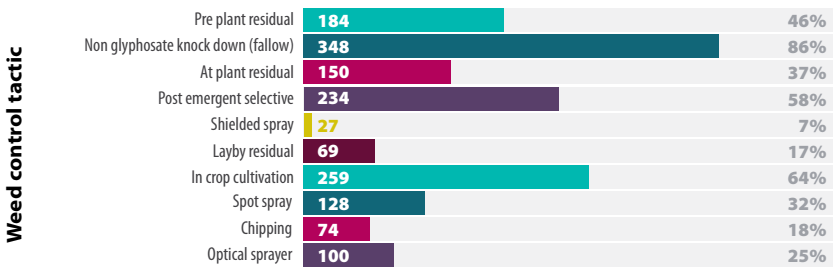
Number of hectares

44

Thinking about your cotton clients, and how they have managed weeds across their cotton farming system, how many use any of the following weed control tactics?

41 respondents

WEED CONTROL TACTICS USED



Number of clients / Percentage of total survey clients

ON-FARM PRACTICES AND ATTITUDES

45

Briefly describe your approach to in crop weed monitoring pre and post spraying?

53 respondents

A lot of walking in-crop.

Inspect the field for weeds and assess size and density, suggest rate. 10 days after application assess effectiveness.

Check weed species, density and growth stage. Check known problem parts of paddock. Spray. Check for efficacy and escapees.

We identify the weed and rate the incidence of the weed across the check points on our checking sheets. Make notes on the weed size/growth stage, health etc. Once we know that the block has been sprayed, we continue to monitor the weeds present and make notes whether they are dying or not.

Check weekly.

Pre spray checking on every hectare. Post spray checking on every hectare.

Weeds are sprayed with in a week or two of emergence. Weeds are monitored and recorded on every visit to field.

Weeds checked in process of checking crop for insects prior to and post spraying.

Pre spray - identify weed species and attempt to age the weed. Post spray - assess level of control, reassess and monitor for survivors. Sometimes tag or GPS mark locations of suspected survivors, try to eliminate other factors that may have caused the weed to have survived.

Field checked twice weekly.

Pre spraying - we try to time the spray in such a way that full weed emergence has occurred pre application (e.g. following an irrigation). We try to target small weeds when possible. Post spraying - we recommend cultivation or in some cases chipping if chemical weed control was incomplete. We have had some resistance testing done on surviving grass weeds.

Visual inspection each time before and after spray.

Weed flushes are examined 5-7 days post rain. Spray/cultivation recommendations sent through. Results assessed 14 days post completion.

Look before and after.

Paddock inspection concentrating on known soil types with hard to kill weeds. Reassess weed control 10 and 20 days post application.

Visual monitoring of all fields pre and post spraying for any survivors following a herbicide application.

Pre spray - identify, assess numbers, size, stress levels, impending operations, crop size, weather. Post spray - check for survivors over the next 1-3 weeks.

Monitor crops for weeds and give recommendations for control at an appropriate level. Cultivation, Glyphosate over the top, Verdict, chipping, Lay-by etc. Post spraying monitor for escapes and advise solutions, cultivation, chipping etc.

I generally have an idea of what weeds a paddock will have based on past history so I can manage early for those difficult weeds. Monitor weeds in crop and spray when required.

Visual assessment.

Assess weeds present, monitor survivors. Assess if it was product or application contributing to survival.

Pre - weed number, type, stage, stress level, crop stage, weather conditions. Post - weeds remaining and health, what further control (if any) is required.

Assess spectrum, density and consider in terms of other operations including irrigation scheduling, crop stage etc. Assess efficacy post spray.

Field walks to identify the weed population density and spectrum pre spray and then field walks post spray to ensure full control and id misses/escapes/potential resistance etc.

Checking before and after.

Visually assessed each week on every walk into every field.

Most weed issues came after a rainfall event early or following irrigation.

Weed type and size are noted while scouting fields pre spray. Level of control of weeds is noted while scouting post spray, other tactics are then recommended if further action is required.

ON-FARM PRACTICES AND ATTITUDES

We use paddock history and weed history to determined pre-emergent strategies needed at planting, once we determine the primary weed issues we then decide on the strategy best suited. Monitoring is done whenever we are in field monitoring our crops, with follow up applications recommended when needed. We are also trying to take a no seed set approach with weed management. If weeds such as ryegrass are suspected of being resistant, we get seed tested where needed.

Drive all 4 sides of irrigation fields and walk into an area of the field. Revisit ex refuge areas or know weedy parts of paddocks frequently. Check sprayed area after application for any misses or suspected resistance.

Weekly for a month after rain and weekly 2 weeks after spraying.

Field surveys, early season NDVI.

Identify weeds likely to cause issues on these fields over time. Identify all management options. Identify management options applicable to this situation. Recommended management decisions.

Watch, spray, analyse, determine percentage resistance.

I check my irrigated crops on foot and on a two wheeled motorbike down the row. I check dryland cotton on foot, on a motorbike or sometimes in the ute (down a spray track). Mostly I would check 50-100mtrs of row at 3-4 sites per management unit every check so covering pre and post herbicide application. I also return to targeted problem areas to assess control.

During normal crop checking monitoring the weed population, size of weeds then advising on weed control methods and timing, after spraying or cultivation reporting on efficacy of control.

As per any other crop - keep an eye out for survivors. When finding a survivor, collect sample to confirm resistance. Also check with client in the manner of application.

I keep an eye out for weed presence and success or otherwise of weed control applications every time I enter a paddock to check for insects and/or to monitor crop growth.

Know weed spectrum from previous history. Apply a targeted pre-emergent chemistry. Tank mix actives and spraying early or healthy plants. Chipping or cultivating survivors where necessary.

Observation.

Identify weeds and spray as small as possible. Monitor results for the following couple of weeks. Send samples off if weeds get through if not already known to be resistant.

Try to alternate and use preemergence where possible. Inspect crop 5 days after applications.

Whenever scouting looking to see if weeds have come through a spray.

Note species, weed growth stage/size, vigour, population, soil moisture conditions. Post spraying - checking for control and identifying issues if control is inadequate.

As I would for any crop pest, close prior to spray and very close post spray for effectiveness and to identify if further actions are required. Main aim is always zero weed seed set and control as early as possible to maintain minimal negative effects to crop and available soil moisture.

Observe field weed density and ID weeds present + growth stage. Prioritise fields for spraying. Post spray - check results from spray.

Proactive approach, try to control when weeds are young and monitor to see how control is.

Check fields pre spray, make appropriate recommendations and monitor post spray to confirm control.

Checking known patches pre and post spray, checking likely shading, scouting large areas of field.

Look for weeds in all fields once a week and spray when they reach then economic threshold to spray. Check spray result weekly after application.

Weeds are monitored twice a week in crop in conjunction with twice weekly insect checks. Death of weeds after spraying is evaluated and decisions made as to any further treatment. Cultivation success is also evaluated with the grower. Fallow fields are monitored during the winter months on long fallow paddocks as back to back fields less of an issue due to constant workings with deep ripping, fertiliser, bed prep etc.

Assessments for herbicide selection and rates, then check roughly 5, 10 and 21 days post spray to determine success or need for a double knock.

Good visual checking and appropriate due diligence in control option selection.

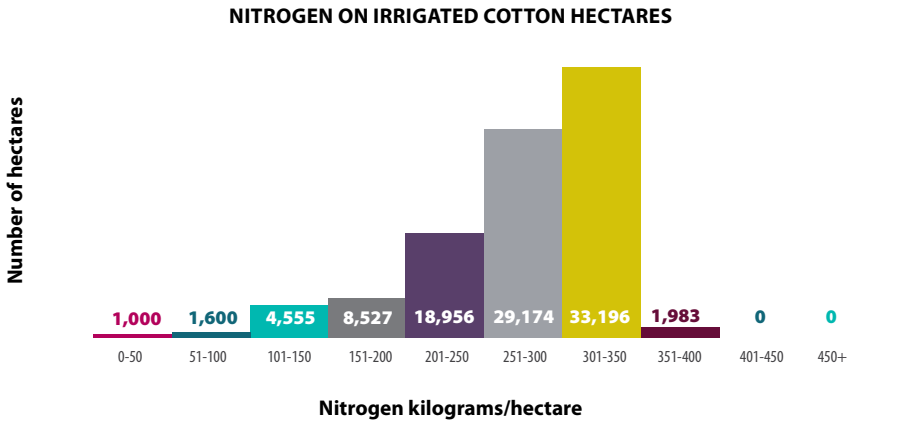
ON-FARM PRACTICES AND ATTITUDES

NUTRITION

46

What is your best estimate on how much nitrogen was applied per hectare for your total irrigated cotton hectares in 2018-19? *

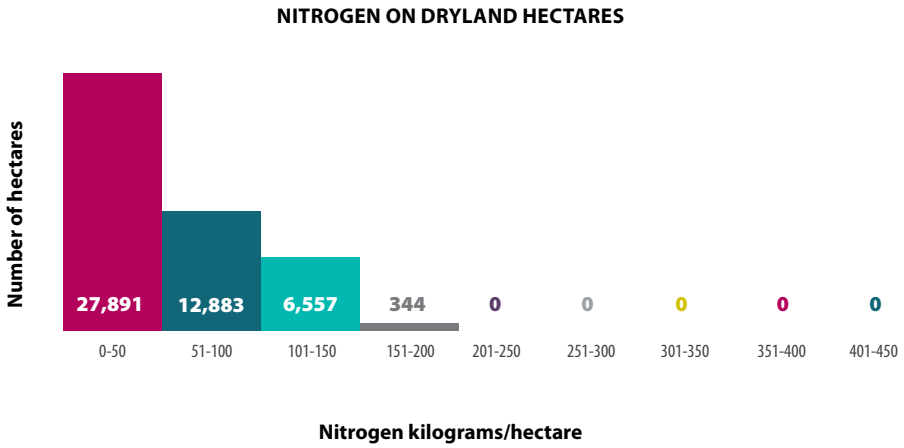
38 respondents



47

What is your best estimate on how much nitrogen was applied per hectare for your total dryland cotton hectares in 2018-19? *

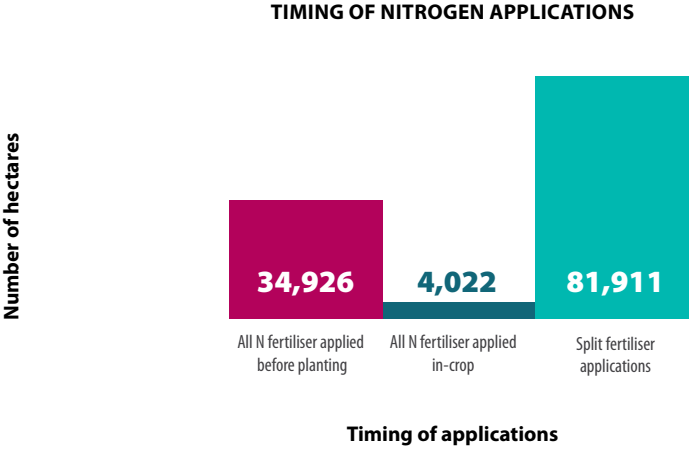
29 respondents



48

In 2018-19, when were the cotton crops' nitrogen fertiliser requirements applied? *

46 respondents

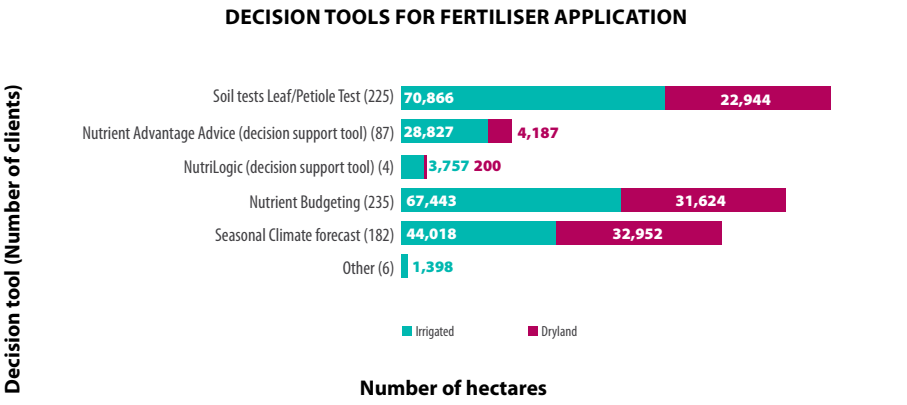


ON-FARM PRACTICES AND ATTITUDES

49

What decision tools are used by you and/or your clients to assist with decisions regarding application of fertiliser for your cotton clients and their irrigated hectares and dryland hectares? *

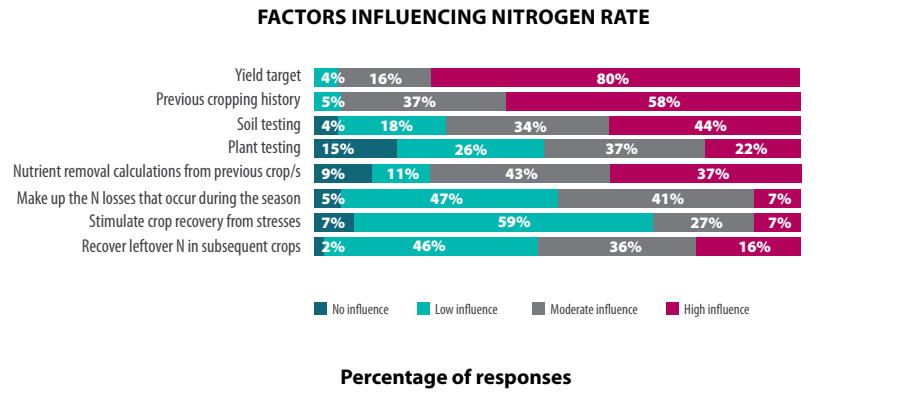
40 respondents



50

What are the factors that influence your recommended nitrogen rate?

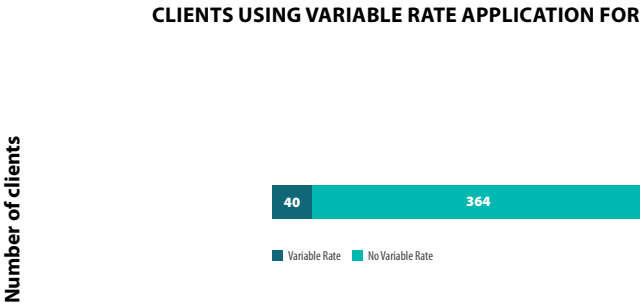
57 respondents



51

Thinking about your cotton clients, how many have used variable rate application for nutrition (N, P, K, S, or minor elements) for 2018-19 cotton crop?

38 respondents



ON-FARM PRACTICES AND ATTITUDES

52

What has been your experience with variable rate nutrition and are there barriers to adoption?

49 respondents

It's only been nitrogen and generally only applying more at the head ditch to compensate for movement.

Minimal, but feel in most cases it's trying to be too cute when other factors will create more yield impact, i.e. climate.

Difficult to get results. Not consistent. More benefits to be achieved by improved water efficiency.

We haven't used it. Our soil types are reasonably uniform, and the growers don't feel the need to use it.

Not practiced presently.

Urea is water run so no variable rate.

Little used so far. Yield map management platforms, machinery.

Irrigated crops - cost of fertiliser is cheap compared to the cost of missing yield. Dryland crops - cost of fertiliser is expensive and application techniques such that soil moisture may be lost at incorporation, so less is applied or applied as surface spread prior to rain and fingers crossed it moves into the soil profile when it does eventually rain, or applied in excess to the crop prior to the cotton. Barriers to variable rate - having all the equipment to do everything from start to finish. Many farms have part of the story but not all (work out where the variable rate should go, organise the map, skill on farm to manage the data, machinery or technology to apply the variable rate).

Cost and return on investment.

Variable rate nutrition is becoming easier to implement as field mapping technologies improve.

We haven't really used any as yet on a large scale.

It is very difficult to establish what zones need more and what zones need less. Soil tests not the answer. Do you fertilize the good high yielding areas more to get more out of them or do you fertilise the poor areas moor to hopefully lift their yields up?

Truly identifying what nutrient is low and affecting yield.

General experience has been positive with clients that have been using it for a number of years now. Most are just varying N rates from head-ditch to tail drain to account for leaching during the season. Very easy to do and setup and works well. Barriers are still cost for some growers and also the understanding of where to go to take the first step in getting setup.

Very useful for N application to even out head ditch/tail drain differences. Only real barrier is cost of equipment if they don't already have gear to be easily modified.

Good experience, just need very soil testing across the field.

Not required in a lot of cases as it's not the driving factor of yield. Conversion of software to hardware is difficult - on farm management.

Have used little of this. Most of our paddocks are quite small. We look closely at paddock topography and drainage; our goal is to not use variable rate but to have an even paddock as much as possible.

Needs to be big enough area to justify and limited in rate increments as dictated by plane (or spreaders now able to do so too). Some growers want to target 16B plus, some don't - thus some likely to go down the variable rate path whereas some don't think its warranted. Can work well if done correctly.

Access to equipment and adequate data collection.

Country is extremely even soil type, so limited need for fields to be managed differently.

Minimal experience due to client base not having the equipment to perform this operation, due to their perception of the cost:benefit ratio.

None, too hard basket.

Validating the performance and success of applications, we haven't done enough work fixing our soil types yet and it should be the first issue before trying to fix variable rate nutrition.

The farmer and the equipment he has. Works well with aerial contractors. At farm are doing some cool things with an app that they are developing to allow growers to do vary rate of a GPS pin on their iPad while driving in the field.

Lack of equipment to be able to variable rate and not sure what we are variable rating.

Cost of getting the map, lack of equipment set up to variable rate, water running N meaning that vary rate not possible.

ON-FARM PRACTICES AND ATTITUDES

Have done successfully in the past and will continue to do sow when adequate variability if present. Ability to get accurate data early season of NDVI or equivalent imagery a possible barrier.

Easy to do and simple to adopt.

I have had some good experiences, but I think the biggest impediment to adoption has been lack of accurate long-term yield data that correlated to actual field variation.

Soil types are fairly uniform, so variable rate not so applicable. Applying just enough fertiliser is likely to result in areas of insufficient fertiliser and reduced yield, the risk is too great for a small saving in costs.

Client adaptation.

Barriers to adoption include the cost to do enough grid soil testing to be confident of the prescription map for the variable rate application. I am of the opinion that the information gleaned from EM surveys backed up with a few soil tests is not enough information to be confident with variable rate fertilizer applications. I think that where variable rate applications have been made to apply more nitrogen at the head ditch end and less at the tail drain end of a field this has generally worked well, however I think the rationale is flawed where the same approach has been used with phosphorus and potassium.

Very little experience. Main barriers appear to be lack of knowledge around how to create a VR map and having the gear to apply VR.

It is additionally influenced by residual stored moisture. So by gaining an understanding in the variability in that and then the underlying soil variation is the main influence. Picking the high yielding years would also help increase profitability. P & K could be managed better by identifying soil type variation. Nitrogen with soil moisture and its ability to drive yield once the grower has a way to identify the variation whether by yield map, EM, or satellite map and has the drive to want to manage it differently then adoption should be simple. Major barrier in dryland situation is know when to apply and in particular for Deep P& K for best response. Cost of not doing it will ultimately increase adoption.

No experience to date. Will be experimenting with one client this year.

Haven't done too much with it, other than when apply foliage to rectify stresses. Adoption issues would be technology uptake, cost and more intensive soil testing.

Good results, clients just need more equipment.

Soil testing costs are still the main barrier to increasing use of this technology. We should be able to get reasonable accurate testing for under $20 a test. We could then take one every hectare or so and utilise the technology properly.

Very limited experience. Limited industry research. Limited cost saving vs potential yield penalty.

Cost to setup equipment, cost to benefit ratio for contractors. Agronomic benefits are clear-but current economic environment dictates austerity.

Base VR rates off soil test data (not yield maps). Variation exists despite previous history of Fert use. Barriers to adoption include machinery setup (spreader). Costs associated with testing.

Have clients look into it and requirements to upgrade equipment and that large cost has been a barrier.

Very positive results.

Difficult to implement in dryland with small zones, not overly cost effective, tend to rob Peter to pay Paul! Much the same rate N goes on whole field anyway so keep it simple. Can see it to be more cost effective to do in irrigation.

Only used it in winter crops. Don't see a need for it in cotton at the moment because it is cheap, and we simply put on a little bit extra to make sure it is not the limiting factor.

The majority of my growers will work on soil tests from the highest yielding areas of fields and compare against soil tests from low yielding areas, elevation data is also considered so as to avoid waterlogged areas that are low yielding. Generally, the fields are then fertilised with regards to P & K as to what the lower yielding areas need and happy to have nutrients build up in the higher areas as we know these will be available in the future. For N we rely heavily on our soil tests, previous crop yield and the maximum yield we are after allowing for a "decent" season with full in crop water. We don't tend to do variable rate fertiliser except after fields have been re-lasered so as to increase fertiliser on the cut areas.

Very little, logistics is the biggest barrier.

Lack of grower knowledge.

APPENDIX

QUESTION 18

Describe the 2017-18 cotton season in three words or less.

Hot	24	Low-Yielding	1
Dry	23	Not Bad	1
Challenging	10	Not Much Rain	1
Hard	2	Relentless	1
Long	2	Rewarding	1
Whitefly	2	Significantly Reduced Income	1
Awful	1	SLW	1
Best-Ever	1	Small	1
Busy	1	Success, Where Water	1
Didn't Rain	1	Successful	1
Difficult	1	Sunny	1
Drought	1	Terrible	1
Excellent with Water	1	Testing	1
Extreme Heat January	1	Tough	1
Frustrating	1	Tough, Seasonally & Mentally	1
Glad it's Over	1	Unpleasant	1
Good then Dry	1	Very Difficult	1
Great but Small	1	Very Dry	1
Heat Affected Flowering	1	Very Very Dry	1
High-Water, High-Yields	1	Water Limited	1
Irrigation	1	Worrisome	1

NOTES

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