CottonInfo Extension Activity Report

Part 1 - Summary Details

Please use your TAB key to complete Parts 1 & 2.

CRDC Project Number: CSD2104

CSD:

Project Title: IPM: Demonstrating the ability of the crop to compensate for early season insect damage

Project Commencement Date: 1/10/2020 **Project Completion Date: 1/09/2021**

Recognition of support: The Research Provider Cotton Seed Distributors acknowledges the financial assistance of the Cotton Research and Development Corporation (and if applicable add other funding partners or grants) in order to undertake this project.

Part 2 – Contact Details

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Date submitted: 7th oct 2021

Part 3 – Final Report

Background

1. Outline the background to the project.

Over the last three seasons, DAF, CSIRO and NSW DPI have been working together to look at the impact of retention on subsequent yield potential and maturity for high yielding cotton. The industry has evidence that many early sprays are "prophylactic" in nature and are timed in some cases to coincide with over-the-top Glyphosate application. It is also a common held belief that the southern regions do not accumulate the growing day degrees to be able to allow a plant to 'compensate' for any early damage, thus there is a tendency to spray all pest activity in the early crop stages. Both practices can adversely affect insect control through the potential impacts of insecticide resistance and a use of non-target insecticides (harder chemistry) impacting beneficals and potentially flaring mirids, mites and mealybugs. IPM is encouraged throughout the cotton industry and cotton managers need to better understand crop physiology and the crop response to early season insect damage.

Objectives

2. List the project objectives (from the application) and the extent to which these have been achieved.

Aim: The trial aimed to demonstrate that high yielding Bollgard® 3 varieties can fully compensate for extensive square loss prior to flowering across a range of environments without compromising lint quality and time to maturity or requiring additional management inputs.

The objectives of this trial are:

1. Improve grower understanding and create confidence around important early season spray decisions - **Complete**
2. Provide a better understanding of the physiology of Bollgard®3 varieties in different growing regions and climatic conditions - **Complete**
3. Provide sites for cotton catchup meetings to demonstrate the ability of the crop to compensate from three varying damage scenarios - **Complete**
4. Evaluate the effect of early season damage on overall yield and quality across the growing regions - **Complete**
5. Demonstrate what could practically happen if a commercial crop underwent moderate to extreme levels of damage during the peak growing season - **Complete**

All REO sites were completed (except for the Narrabri site, which had to be abandoned due to several hail events). Paul Grundy has completed the industry trial report. Regional reports are currently being done for distribution to co-operators, consultants etc.

3. Detail the methodology and justify the methodology used. Include any discoveries in methods that may benefit other related projects.

Methods

CottonInfo Regional Extension Officers undertook local versions of the existing Industry Retention trial coordinated by Paul Grundy in each of the growing regions. There was 13 locations, seven of the sites were full research sites and the remainder (6) were satellite study sites (REO's).

The Trial locations included:

- Cecil Plains - Annabel Twine
- St George - Andrew McKay,
- Mungindi - Janelle Montgomery
- Warren and Trangie - Amanda Thomas
- Benerembah - Kieran O'Keeffe
- Narrabri – Elsie Hudson (trial abandoned due to hail)
- Full research trial sites were also established by the DAF, CSIRO and NSW DPI at Comet, Norwin, Brookstead, Goondiwindi, Moree, Whitton and Leeton.

A protocol for the CottonInfo trials was developed by Paul Grundy, in consultation with Amanda Thomas and Annabel Twine, and was based around replication of the larger Industry Retention Trial. It was simplified to be able to be carried out by the CottonInfo REO's in each of the growing regions. A summary of the steps undertaken by the REO's are listed below. See appendix 1 for the full protocol

REO's identified a collaborator who routinely grows high yields and set up a site within a "typical" field.
The 4 treatments were:

1. Undamaged.
2. Squares damaged on first 5 fruiting branches (1-5) when crop was about 14-15 nodes (approximately a week from first flower).
3. Squares damaged on next 5 fruiting branches (6-10) leaving lower branches intact when crop was about 18-19 nodes (approx. a week after first flower).
4. Squares damaged on fruiting branches 1-5 & 6-10. Damage was enacted at the same time as the other two treatments (so two events). Bottom branches were not damaged twice.

The treatments were randomised and replicated 4 times over the trial site.

Once implemented the REO's monitored the crop every 2 weeks and took photos of treatments for compensation comparison.
There were 3 yield related assessments:

1. Maturity picking. This entailed hand picking seed cotton and recording the number of bolls picked each week from 10% open until maturity. This measured any differences in treatment maturity. The section picked was 3m.
2. Segmented picking. Key data from the retention experiments has come from segmented hand-picking assessments where the number and weight of bolls from the canopy are recorded. The section picked was 2m.
3. Handpicking. This is a bulk hand pick of a further 3-5 metres which when combined with the other hand picks will provide 10m of row picked for yield assessment.

All picked cotton was returned to CSIRO, DAF or NSW DPI so that it was accurately weighed for assessment and then subsampled for mini ginning.

Outcomes

4. Describe how the project's outputs will contribute to the planned outcomes identified in the project application. Describe the planned outcomes achieved to date.

1) The trials were conducted across 7 locations (REO's) with the aim of being on farm extension/research activity sites. REO's were able to report the following outcomes:
    a. Increased understanding of the impact of early season damage on final yield.
    b. Increased awareness of the cotton plants ability to compensate
    c. Improve grower confidence in making early season spray decisions
    d. Create and promote awareness of the consequences of prophylactic sprays

- The whole project was an on-farm research based extension activity that was a talking point throughout the season. REO's used social media and newsletters to provide updates and photos of the trials throughout the season. The plants provided excellent visuals of compensation as the plant matured through growth stages. Development was captured every two weeks and told a compelling story.
- Cotton catchup meetings and field walks were held at the sites – Paul Grundy was able to present in person at most of these meetings. It was very informative to pull plants out of the ground and look at the compensation for each of the treatments – IPM messaging was key to explaining that early season spraying can often be prophylactic and lead to SLW problems later in the season. SLW messaging and parasitism training was also provided at the cotton catchup meetings. (See appendix 2 for further details)
    e. Demonstrate and evaluate if early season damage has an impact on yield, maturity and quality
- The trial showed that the inflicted damage had no effect on yield at the 7 sites. Early square removal improved yield at one site (Cecil Plains). Extreme damage treatment of square removal from FB 1-10 reduced yield at 2 sites (Warren & Benerembah).
- Lint quality was largely unaffected by the damage treatments across all sites with micronaire being the only parameter altered at Warren for FB 1-10. Low micronaire at Benerembah impacted all treatments equally.
- The yield was impacted at the Leeton, Benerembah and Whitton and this shows that **caution may be required for far southern production sites**. There are many possible factors at play but work from this season shows potential issues such as cultivar, defoliation timing and environmental factors can all play a part. More work in these areas will help to tease out contributing factors next season.
- For hotter regions north of Narrabri, the data again solidly showed that early season fruit loss is unlikely to impact yield quality or crop maturity.
- Early square removal prior to first flower or just after first flower did not significantly impact yield at any of the sites except for Leeton and Whitton.
- The extreme treatment of removal of squares from the fruiting branches 1 -10 reduced yield at four of the 11 sites and apart from Goondiwindi these were all cooler region sites. This result is quite amazing given the damage that treatment was doing to the plants before peak flowering was about to begin. The data captured from this treatment could be useful when growers experience things like hail or spray drift in the early stages of growth. A consideration where this does occur is to be mindful of mepiquat chloride application post damage as it could impact the compensation process.

The full report for the trial work is provided in Appendix 3. It has been compiled by Paul Grundy. A regional report will be complied by each REO and distributed to regional contacts and trial co-operators.

5. Please report on any:-

a. Feedback forms used and what the results were
b. The highlights for participants or key learnings achieved
c. The number of people participating and any comments on level of participation

a. This trial included an evaluation component that included capturing feedback from growers during the Cotton Catch-up and farm walks. This feedback is detailed in Appendix 2. There were no feedback forms used specifically for the retention work.
The protocol developed for the REO trials has been evaluated by the CottonInfo REOS to see what could be simplified or improved. Feedback will be incorporated and used when updating the protocol for the 2021-2022 season. This may include changing the treatment of the southern sites to better reflect realistic damage and shorter growing season.

b. The following key learnings have been reported by the CottonInfo REO team.
- Given that that the treatments were often taking the retention back to less than 50% and the current industry standard for that crop stage is 60-70%, these treatments would represent very extreme damage.
- The season was a slightly cooler one compared to past seasons that the trial has been completed in. This was good as some growers expressed interest to know what impact early season damage had on final yield and maturity in a cooler season.
- This trial enabled the conversation around choice of early season chemical and if spraying to protect early squares will have any long-term benefit. It also led to discussions around soft chemistry (IPM) and what the benefits are at the end of the season by taking this approach in terms of SLW and mealybug management.
- Reports from growers provided at the cotton catchup meeting showed that some sprays are prophylactic in nature and are more about protecting the crop from anticipated damage (it often coincides with scheduled weed spraying). The feedback captured at the Southern meetings is that growers strive for earliness when growing cotton and delaying sprays and damaging squares can lead to less yield and delayed maturity, around the plants ability to compensate. More work around this area is very important to growers in the south.
- In a commercial environment it is often difficult to allow young plants to drop squares and consultants and growers feel they do not currently have enough information around the plants ability to compensate. The aim of the trials is to get this confidence and information as people tend to look back on missing squares or fruit and attribute it to insect damage. Our trial shows that some years the plant doesn't set fruit until later and this is more likely due to environmental constraints. The trial did prove this as the control plants were also missing fruit lower on the plant.
- All the REO's involved in the trial reported a better understanding of plant physiology in their regions. The growers who hosted the trial also reported a better understanding of the plants ability to set fruit in a compensatory manner after early damage impacted squaring.
- The collaboration between the REO's and Paul Grundy's research team was a positive one for the exercise, having the research team come and assist with harvesting bolls and interacting with them gave all involved a better understanding of what goes into the research process and how important it is to replicate and continue to do the work over consecutive seasons.

c) The REO's worked closely with 6 trial co-operators and a number of farm staff throughout the season. 220 participants including 46 growers, 36 consultants, 9 researcher and 26 industry personal located from Griffith to St George. A detailed account of the CottonInfo Cotton Catch-ups and farm walks were information regarding this trial was extended is provided in Appendix 2.

Conclusion

6. Provide an assessment of the likely impact of the results and conclusions of the research project for the cotton industry. What are the take home messages?

Take home messages from the CottonInfo REO Trial:

- For hotter regions north of Narrabri, the data solidly showed that early season fruit loss is unlikely to impact yield, quality or crop maturity.
    - The treatments were often taking the retention back to less than 50% and the current industry standard for that crop stage is 60-70%, these treatments would represent very extreme damage.
    - The season was a slightly cooler one compared to past seasons that the trial has been completed in. This was good as some growers expressed interest to know what impact early season damage had on final yield and maturity in a cooler season. The northern trial sites had no negative effect on yield with early season damage even in a cooler season.
    - There was some negative impact on yield and quality at the Southern NSW sites.

Importantly, this work is ongoing and therefore recommendations for industry practice cannot be provided at this stage.

Overall, the research continues to suggest that Bollgard®3 varieties are well placed to achieve timely and effective compensation particularly for early season square loss represented by the FB1-5 treatment. In many instances the control comparison was also subject to loss of early squares, indicating that environmental conditions and or insect pressure impacted the onset of fruit during this period.

We need to remember that even this treatment still represents very extreme damage if we equate it to what we would typically see in the field. These results are still preliminary and should be interpreted with a degree of caution.

Extension Opportunities

7. Detail a plan for the activities or other steps that may be taken:

- The CottonInfo REO's are currently writing up regional reports that can be disseminated locally.
- Key findings will be distributed in CottonInfo e-news and regional newsletters.
- Possible CRDC Spotlight or Australian Cotton Grower article.
- Present findings at Cotton Conference
- Present findings at regional Cotton Catch up meetings in the 2021/22 season.

Appendices

1. Trial protocol 2021
2. REO Extension Delivery 2020/21
3. Industry Retention Report: Grundy et al. *"Impact of early season retention on yield potential in high-yielding Bollgard® cotton*