



## FINAL REPORT Executive Summary

### ***Part 1 - Summary Details***

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

**CRDC Project Number:** DU1502

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**Project Title:** Novel spinning technologies for fine and high quality Australian cotton yarns

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**Project Commencement Date:** 01/07/2014 **Project Completion Date:** 31/12/2017

**CRDC Research Program:** 3 Customers

### ***Part 2 – Contact Details***

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**Date Submitted:** 25 Jan 2018

## ***Part 4 – Final Report Executive Summary***

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Provide a one page Summary of your research that is not commercial in confidence, and that can be published on the World Wide Web. Explain the main outcomes of the research and provide contact details for more information. It is important that the Executive Summary highlights concisely the key outputs from the project and, when they are adopted, what this will mean to the cotton industry.

Yarn hairiness control has become a “holy grail” of research in ring spinning. A significant amount of research effort has been devoted to the study of yarn hair generation and its control. This includes minimising the spinning triangle width and re-incorporation of protruding hairs into the yarn body. These methods led to development of different technologies, which performed the task by condensing the roving during drafting (compact spinning), untwisting-retwisting of spun yarn using swirling air jets (JetRing spinning) and splitting the drafted roving into multiple small roving strands (Solospun™ system). Of these, compact spinning is the most popular and widely used in spinning industry. However, this technology comes with significant additional cost in terms of the compacting unit (pneumatic or mechanical) and its maintenance during spinning. There is therefore still significant demand from spinning mills for new methods of hairiness reduction that require minimum investment costs.

The spinning triangle (ST) is the zone where the fibre fringe of a roving is converted into yarn and the site where hair generation occurs as a result of fibres at the edge of the drafted fibre strand not being incorporated into the yarn body. The geometrical dimensions of the ST are critical in controlling the hair formation tendency of the fibre strand. Until the concept of offset spinning came to light, the width of the ST was the only geometric parameter considered in research to reduce yarn hairiness. Offset spinning has been shown to improve hairiness in cotton yarns. However, in the absence of a mechanical support, an offset ST is prone to fibre loss, which results in high unevenness in yarn linear density.

This project focussed on detailed experimentation of offset spinning to improve the quality of ALS cotton yarns using a novel insert device. The major tasks of this project involved systematic spinning trials and design of an insert device to assist in controlled offset spinning of cotton yarns. The offset device was designed to be a simple retrofit unit which can be installed on the spinning machine with minimal installation and maintenance cost. The device demonstrated a significant improvement in yarn quality parameters, yarn hairiness in particular. The main project conclusion outlines that offset spinning is a simple geometric modification of the ST for producing yarns with reduced hairiness. However, the direction of offset plays an important role in determining this effect. A right-hand offset (RO) is effective in reducing hairiness for a Z-twist yarn while left-hand offset (LO) deteriorates hairiness results. An opposite effect is observed when the twist direction is changed. Fibres from both edges of ST undergo significant change in their wrapping behaviour depending on the direction of offset. The advantages of the insert device for Australian cotton relates to its potential ability to improve conversion of long staple Australian Upland, which typically has poorer tenacity and SFC values than SJV and Pima cotton. The ability of the device to improve yarn qualities affected by these properties means that Australian cotton value is improved. In the same way, the device could also improve the count able to be spun consistently from 100% Australian long staple Upland, e.g., from Ne 40 to Ne 50 (15 to 12 tex) and even Ne 60 (10 tex), which is a market currently limited largely to high quality SJV and Pima cotton.

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