Australian Wool Innovation Limited

2022 FLYSTRIKE RD&E

TECHNICAL FORUM

Welcome & Introduction

Bridget Peachey – AWI

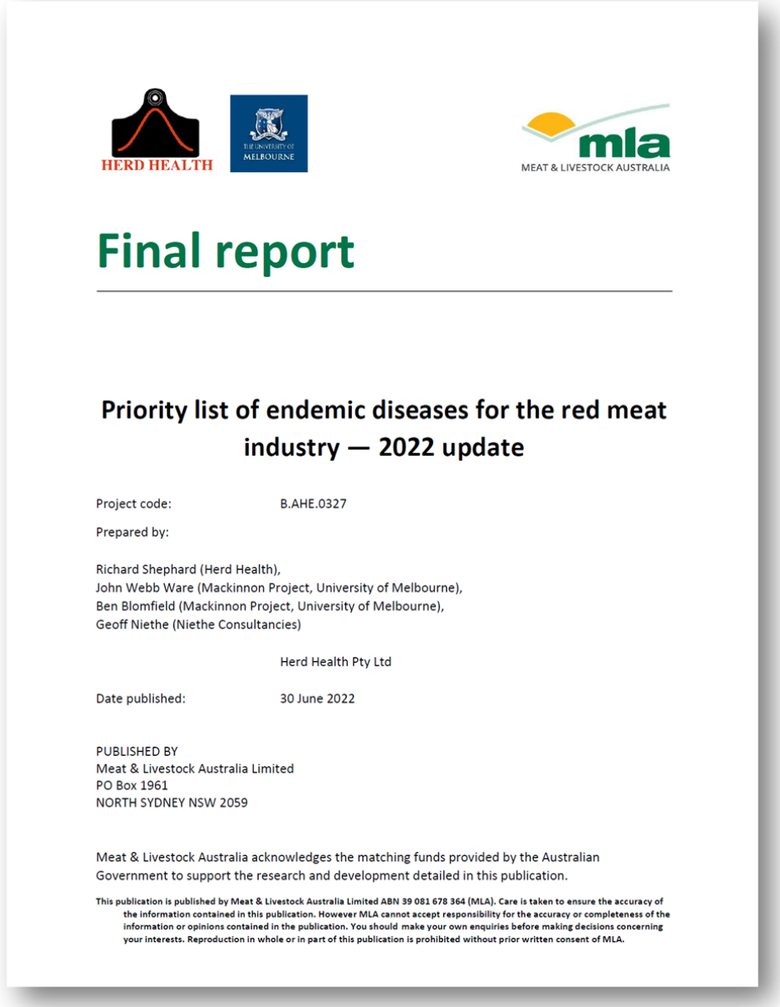
10 August 2022

Source: ABC News

Source: Sky News Australia

Economic cost of flystrike ($M)

	2015	2022
Treatment	$11.34	$12.50
Prevention	$57.30	$83.80
Production Losses	$104.53	$227.40
TOTAL	**$173.17M**	**$323.7M**



HERD HEALTH

THE UNIVERSITY OF MELBOURNE

mla
MEAT & LIVESTOCK AUSTRALIA

Final report

Priority list of endemic diseases for the red meat industry — 2022 update

Project code: B.AHE.0327

Prepared by:

Richard Shephard (Herd Health),
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Geoff Niethe (Niethe Consultancies)

Herd Health Pty Ltd

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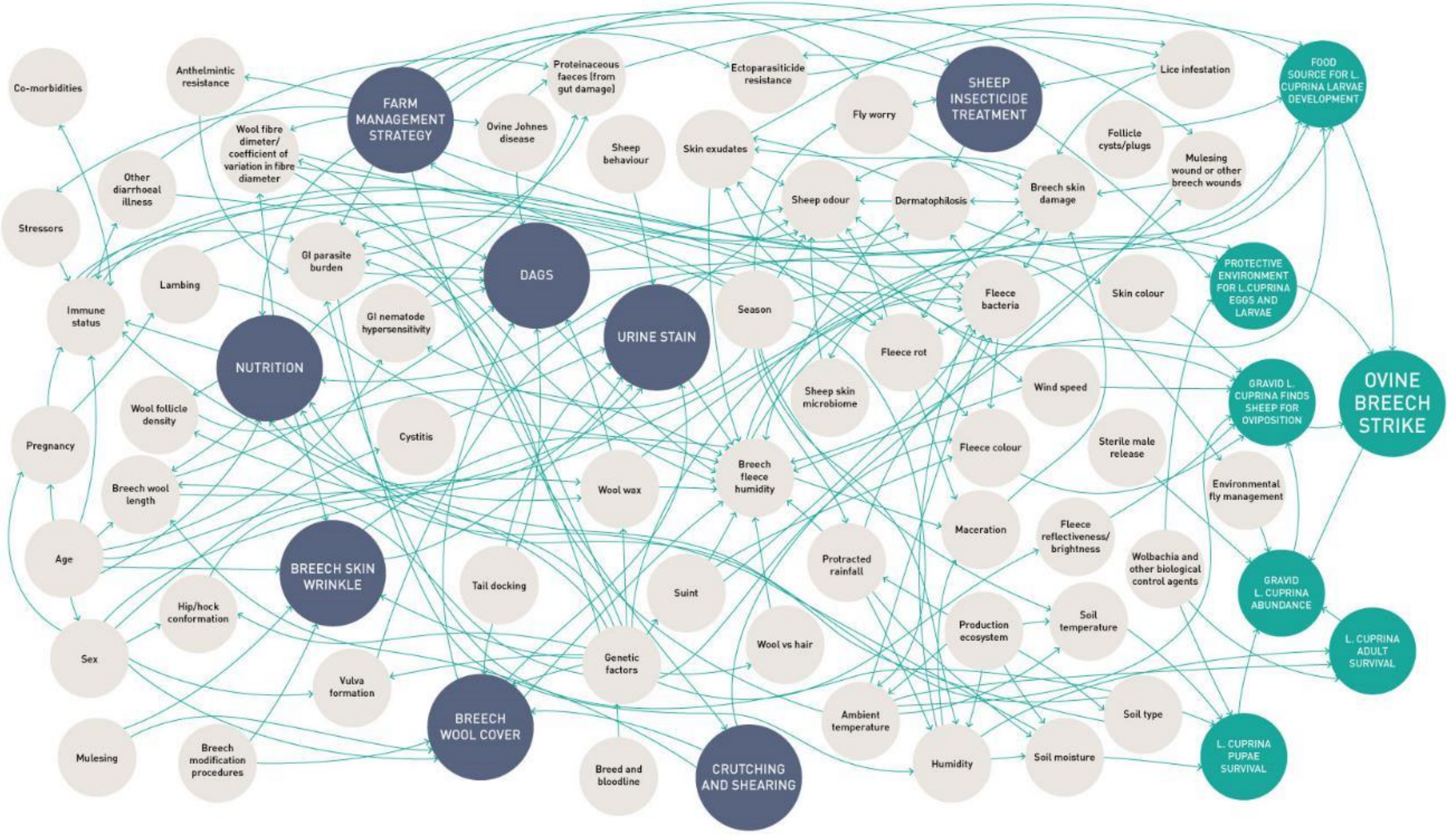

Co-morbidities
Anthelmintic resistance
FARM MANAGEMENT STRATEGY
Proteinaceous faeces (from gut damage)
Ectoparasiticide resistance
SHEEP INSECTICIDE TREATMENT
Lice infestation
FOOD SOURCE FOR L. CUPRINA LARVAE DEVELOPMENT
Wool fibre dimeter/ coefficient of variation in fibre diameter
Ovine Johnes disease
Sheep behaviour
Skin exudates
Fly worry
Follicle cysts/plugs
Mulesing wound or other breech wounds
Other diarrhoeal illness
Sheep odour
Dermatophilosis
Breech skin damage
Stressors
GI parasite burden
DAGS
PROTECTIVE ENVIRONMENT FOR L.CUPRINA EGGS AND LARVAE
Lambing
Fleece bacteria
Skin colour
Immune status
GI nematode hypersensitivity
URINE STAIN
Season
NUTRITION
Fleece rot
Wool follicle density
Sheep skin microbiome
Wind speed
GRAVID L. CUPRINA FINDS SHEEP FOR OVIPOSITION
OVINE BREECH STRIKE
Pregnancy
Cystitis
Fleece colour
Sterile male release
Breech wool length
Wool wax
Breech fleece humidity
Environmental fly management
Maceration
Fleece reflectiveness/ brightness
Age
BREECH SKIN WRINKLE
Protracted rainfall
Wolbachia and other biological control agents
GRAVID L. CUPRINA ABUNDANCE
Tail docking
Suint
Hip/hock conformation
Production ecosystem
Soil temperature
Sex
Wool vs hair
L. CUPRINA ADULT SURVIVAL
Genetic factors
Vulva formation
Ambient temperature
Soil type
BREECH WOOL COVER
Mulesing
Breech modification procedures
Humidity
Soil moisture
L. CUPRINA PUPAE SURVIVAL
Breed and bloodline
CRUTCHING AND SHEARING

SimpliFly™


Reduce the number of susceptible sheep
Limit the impact of weather conditions
Restrict fly populations

Discussion Panel

Where is the future of flystrike RD&E?

Trent Perry - University of Melbourne

Peter James - University of Queensland

Jane Littlejohn - AWI General Manager, Research

FLYSTRIKE RESEARCH, DEVELOPMENT, EDUCATION, EXTENSION AND COMMUNICATION STRATEGY

awi Australian Wool Innovation Limited

VISION

ENSURE THE LIFETIME WELFARE AND PRODUCTIVITY OF SHEEP AND REDUCE THE RELIANCE ON MULESING.

BREEDING AND SELECTION

THE AIM: Long term solutions to advance lifetime welfare.

- Understand the performance and economic impacts of breeding for reduced flystrike.
- Investigate the, as yet unknown, factors that cause flystrike.
- Improve the accuracy of selection for flystrike resistance traits through phenotyping and genotyping.
- Better understand how to reduce the incidence of dags and urine stain through breeding.
- Track genetic trends for breech wrinkle, breech cover, dags and higher productivity.

BREECH MODIFICATION PROCEDURES

THE AIM: Breech modification procedures to improve lifetime resistance to flystrike.

- Undertake further R&D of the animal welfare impacts of breech modification procedures.
- Undertake further R&D to refine the application protocols for breech modification procedures.
- Support best practice mulesing training.

NON-INVASIVE MANAGEMENT PRACTICES

THE AIM: Improved management practices to reduce the risk of flystrike.

- Monitor and define blowfly resistance to chemicals.
- Refine blowfly chemical resistance best practice management advice.
- Invest in early trials of new potential actives and parasitic control treatments and vaccines.
- Complete a population study of blowflies to identify potential genetic differences to inform blowfly management programs.

EDUCATION, EXTENSION AND PROMOTION

THE AIM: Adoption of best practice strategies to improve the lifetime welfare of sheep, reduce reliance on mulesing and support transparency in the supply chain.

- Develop and implement education, training and extension strategies to improve lifetime welfare of sheep.
- Monitor, evaluate and improve the success of education, training and extension strategies.
- Engage with woolgrower advisors on the RD&E program.
- Ongoing engagement with domestic and international stakeholders to ensure they understand best practice management of flystrike and the welfare implications.

ANALGESIA AND ANAESTHESIA

THE AIM: Improved provision of analgesia and anaesthesia for surgical husbandry practices.

- Investigate longer acting, cost effective anaesthesia and analgesia options.
- Extend advice on analgesia and anaesthesia to woolgrowers.

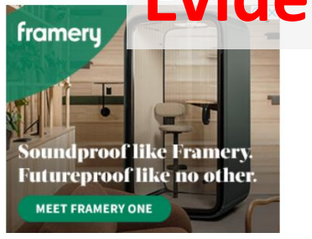
Flystrike vaccine fast tracked with funding boost from AWI

2 Aug 2021, 12:30 p.m. News

CSIRO senior scientist Tony Vuocolo has conducted over 4
two years to measure the impact of the sheep response on la
AWI

An extra $650,000 in funding to fast track a flystrik
approved by Australian Wool Innovation.

The extra fundi ng for a collaborative project with CS
further investig ations into he development of a flys



findings fro
vaccine resea
University of
flystrike, whi
and is reveali
information.

AWI chairma
promises to be a "game changer".

"It's an important investment on behalf of woolgro

AWI to invest $2.5 million in sheep flystrike vaccine research

by Sheep Central, 04 December 2018

AUSTRALIAN Wool Innovation will spend $2.5 million over four years to research a flystrike vaccine for sheep, seen as a potential option to mulesing.

AWI today announced the investment and preliminary research into development of a flystrike vaccine targeting the Australian sheep blowfly as part of a collaboration with the
of Melbourne and

Gains made in flystrike fight

Vaccine the subject of decades of work

Scientists believe they are closing in on
a commercial vaccine for flystrike.

BY CHRIS MCLENNAN

SCIENTISTS believe they are closing in on a commercial vaccine for flystrike.

Prototype vaccines have already been developed halfway through a four-year $2.5-million research project between the wool industry and the CSIRO.

A potential vaccine against flystrike has been the subject

ing a vaccine gained focus through almost a decade of research at The University of Melbourne, which culminated in the mapping of the fly's full genome in 2015 after three years of work.

This $2.5-million collaborative project with Australian Wool Innovation is producing these 'bullets' in a form that will specifically hit the maggots in vulnerable spots and be powerful and plentiful enough to penetrate and ultimately over-run the maggots' armour-like protection.

The blowfly proteins, called antigens, used in the

response of the sheep resu
in the death of the blow
maggot when they feed
the sheep serum.

Serum is the compo
of blood that contains
antibodies.

Unfortunately producing a commercial vaccine through this approach using native antigens is not viable and

Scientists are testing vaccines to defeat flystrike

Chris McLennan
@McLennanCm

30 Mar 2021, 6 a.m.

News

Sheep. Picture: AWI.
CSIRO project leader Tony Vuocolo injects a prototype vaccine into

Scientists believe they are closing in on a commercial vaccine for flystrike.

Prototype vaccines have already been developed half way through a four-year $2.5 million research project between the wool industry and CSIRO.

A potential vaccine against flystrike has been the subject of decades of research work.

Evidence of successful development of a flystrike vaccine

Livestock

Sheep blowfly vaccine shows promise in the lab but fails in field

Research is battling to find a vaccine to control flystrike but early tests keep falling at the first hurdle. Here's what the next move is.

Fiona Myers

2 min read June 22, 2022 - 5:00AM The Weekly Times

0 comments

Flystrike vaccine fails early tests

Research is battling to find a vaccine to control flystrike but early tests keep falling at the first hurdle. Here's what the next move is.

Vaccine researchers strike out, but press on

FIONA MYERS

FLYSTRIKE vaccines that work in a laboratory are failing to produce the same results on sheep.

But researchers are hopeful they can find ways to make two candidate vaccines work more effectively out in the field.

CSIRO researcher Dr Tony Vuocolo said there had been a resurgence in work on a flystrike vaccine after it stalled in about 2000.

"We did some great foundation work over a period of 10 years from the mid-1980s to middle of 2000 and then the work stopped," Dr Vuocolo said.

"We had really come as far as we could with the technologies that were available, but we are in a position now where there is a convergence of technology and capability and knowledge.

"It was time to give the vaccine another good go."

Dr Vuocolo said producing a vaccine was "like an assault on Mount Everest".

"We need to establish a really good base camp of understanding and then plan your assault as you are moving up," he said.

"I am happy to say we are past base camp and have not quite reached Hillary's step yet, but we are well on our way."

The research is now at a point where many vaccines are raising strong immune responses in sheep in laboratory trials and having a real effect on survivability of maggots.

But it is a huge step to move on to later stages, Dr Vuocolo said.

"A maggot is like a World War I tank — it's armour-plated and a really difficult thing to target," he said.

The research has shown the best target area is the maggot's gut. Two vaccines have been developed — one that uses proteins extracted from maggots to produce a vaccine and the other is a molecular approach where key proteins are put into cells and then into a vaccine.

There were more than 50 prototype vaccines developed during the past three years, which have been narrowed down to two lead prototypes.

In the lab, those vaccines caused maggot growth to be stunted, dying or moribund and there was a 75 per cent reduction in weights and growth rates.

But that was not replicated when the trials moved outside the lab with only a 20 per cent reduction on sheep.

"The biggest hurdle at the moment (is working out) what we can do to amplify the immune response on the sheep to be much more resilient to larvae," Dr Vuocolo said.

"We are pretty early into the project and while I would like to be able to tell you there will be a vaccine in the next couple of years, really that is not right."

A spokesman for Australian Wool Innovation said it had invested $2.85 million to support the development of a flystrike vaccine.

Strike force: CSIRO vaccine team members Suzie Briscoe, Neil Bagnall and Tony Vuocolo.

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AWI Project Manager:	Bridget Peachey
Contractor Name:	CSIRO
Prepared By:	Alison Small, Andrew Fisher, Caroline Lee and Ian Colditz
Publication Date:	June 2020

Gap Evaluation of Pain Alleviation Research

Evidence of investigations into novel pain relief options

Published by Australian Wool Innovation Limited, Level 6, 68 Harrington Street, THE ROCKS, NSW, 2000

AWI invests in research, development, innovation and marketing activities along the global supply chain for Australian wool. AWI is grateful for its funding which is primarily provided by Australian woolgrowers through a wool levy and by the Australian Government which provides a matching contribution for eligible R&D activities

animals

MDPI

Systematic Review

Analgesia for Sheep in Commercial Production: Where to Next?

Alison Small [1,*], Andrew David Fisher [2], Caroline Lee [1] and Ian Colditz [1]

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[2] Animal Welfare Science Centre, University of Melbourne, Parkville, VIC 3052, Australia; adfisher@unimelb.edu.au
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Simple Summary: Increasing societal and customer pressure to provide animals with 'a life worth living' continues to apply pressure on industry to alleviate pain associated with husbandry practices, injury and illness. Although a number of analgesic solutions are now available for sheep, providing some amelioration of the acute pain responses, this review has highlighted a number of potential areas for further research.

Abstract: Increasing societal and customer pressure to provide animals with 'a life worth living' continues to apply pressure on livestock production industries to alleviate pain associated with husbandry practices, injury and illness. Over the past 15–20 years, there has been considerable research effort to understand and develop mitigation strategies for painful husbandry procedures in sheep, leading to the successful launch of analgesic approaches specific to sheep in a number of countries. However, even with multi-modal approaches to analgesia, using both local anaesthetic and non-steroidal anti-inflammatory drugs (NSAID), pain is not obliterated, and the challenge of pain mitigation and phasing out of painful husbandry practices remains. It is timely to review and reflect on progress to date in order to strategically focus on the most important challenges, and the avenues which offer the greatest potential to be incorporated into industry practice in a process of continuous improvement. A structured, systematic literature search was carried out, incorporating peer-reviewed scientific literature in the period 2000–2019. An enormous volume of research is underway, testament to the fact that we have not solved the pain and analgesia challenge for any species, including our own. This review has highlighted a number of potential areas for further research.

check for updates

Citation: Small, A.; Fisher, A.D.; Lee, C.; Colditz, I. Analgesia for Sheep in Commercial Production: Where to Next? *Animals* **2021**, *11*, 1127. https://doi.org/10.3390/ani11041127

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1. Introduction

Increasing societal and customer pressure to provide animals with 'a life worth living' continues to apply pressure on industry to alleviate pain associated with husbandry practices, injury and illness. A substantial body of research into the impacts of sheep husbandry procedures such as castration, tail docking and mulesing has highlighted the need for analgesic strategies or alternative management approaches, and in recent years non-steroidal anti-inflammatory drugs (NSAIDs) and local anaesthetic formulations specifically registered (authorised by the Competent Authority, also known as 'licensed' in some jurisdictions) and delivery methodologies specifically designed for sheep have become available in a number of countries. However, even with multi-modal approaches to analgesia, using both local anaesthetic and NSAIDs, pain is not obliterated, and the challenge of pain mitigation remains. It is timely to review and reflect on progress to date in order to strategically focus on the most important challenges, and the avenues which offer the greatest potential to be incorporated into industry practice in a process of continuous improvement.

RURAL NEWS

NATIONAL WORLD OPINION AGRIBUSINESS MANAGEMENT FARM HEALTH MACHINERY & PRODUCTS MOTO

Friday, 22 July 2022 08:55

Aussies look at new approach to flystrike control

Written by Staff Reporters

font size | Print | Email

Tiny nanoparticles less than a thousandth of a millimetre in size are providing a promising new method to protect sheep against flystrike, according to University of Queensland research.

Dr Peter James believes nanotechnology could be part of the solution to a problem that costs the Australian sheep industry AU$173 million a year.

Senior Research Fellow Dr Peter James from UQ's Centre for Animal Science believes nanotechnology could be part of the solution to a problem that costs the Australian sheep industry AU$73 million a year.

"New methods that can provide longer periods of protection are required to counter the development of resistance to flystrike, insecticides and to support the reduced reliance on mulesing, a surgical technique that has been relied upon over many years," James says.

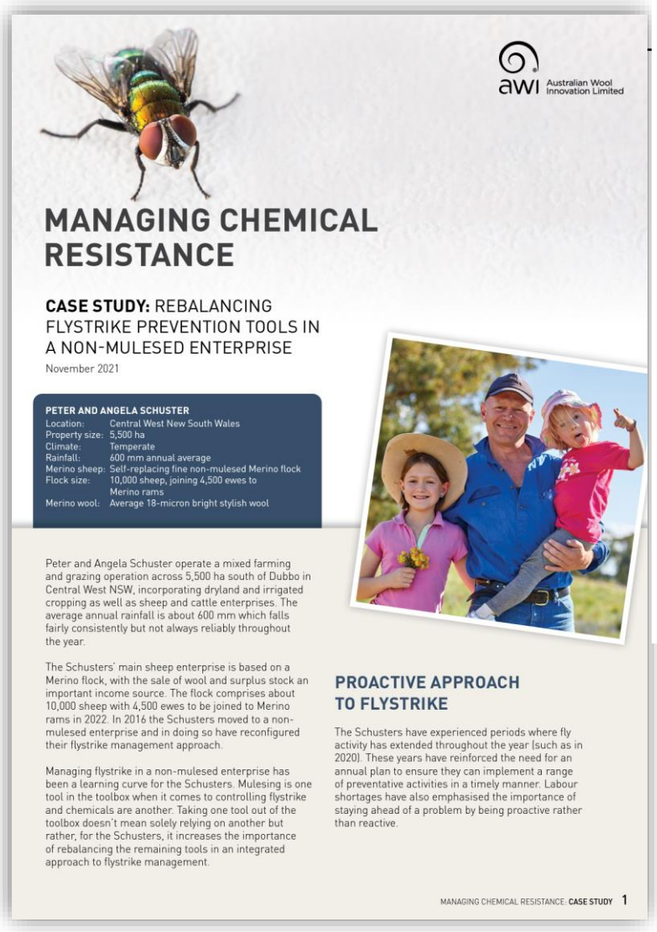
The Australian Wool Innovation (AWI) funded project is designing and testing unique silica nanocapsule particles with surface spikes purpose-built to give prolonged periods of protection against flystrike and lice.

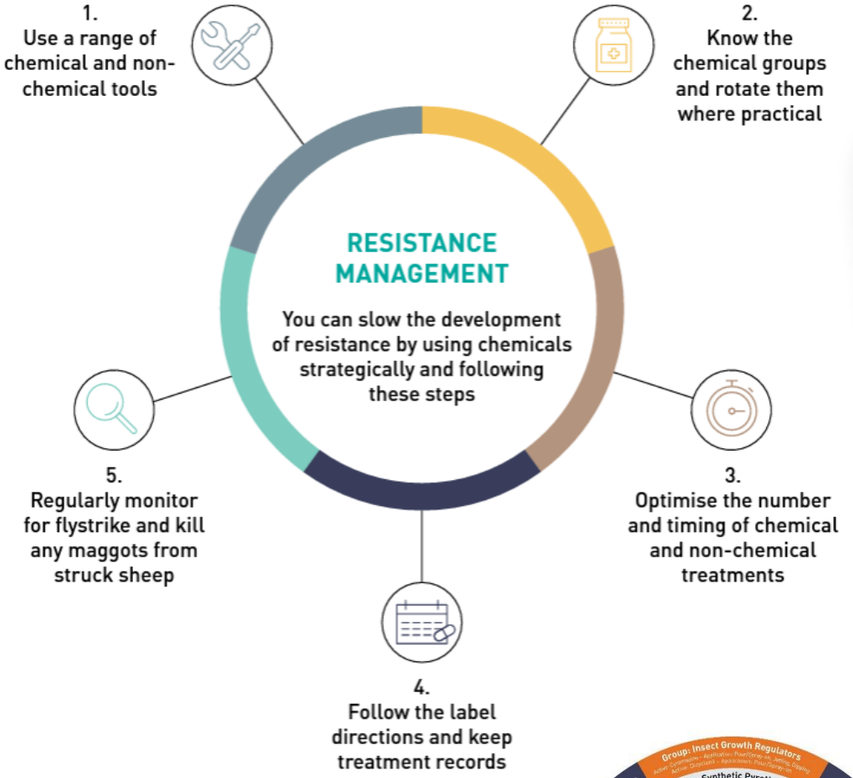
Nanotechnology extends period of flystrike protection in sheep

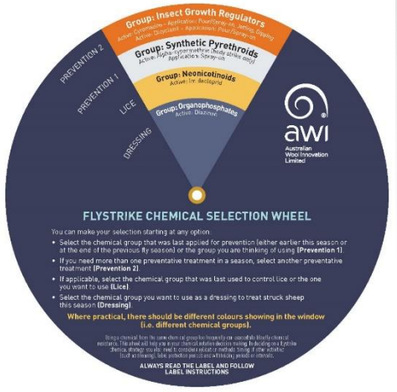
By Shan Goodwin
Updated July 5 2022 at 3:52pm, first published June 30 2022 at 8:00am

Question for the Panel:

What opportunities are there for nanotechnology with respect to improved delivery of current analgesia and or anaesthesia options?



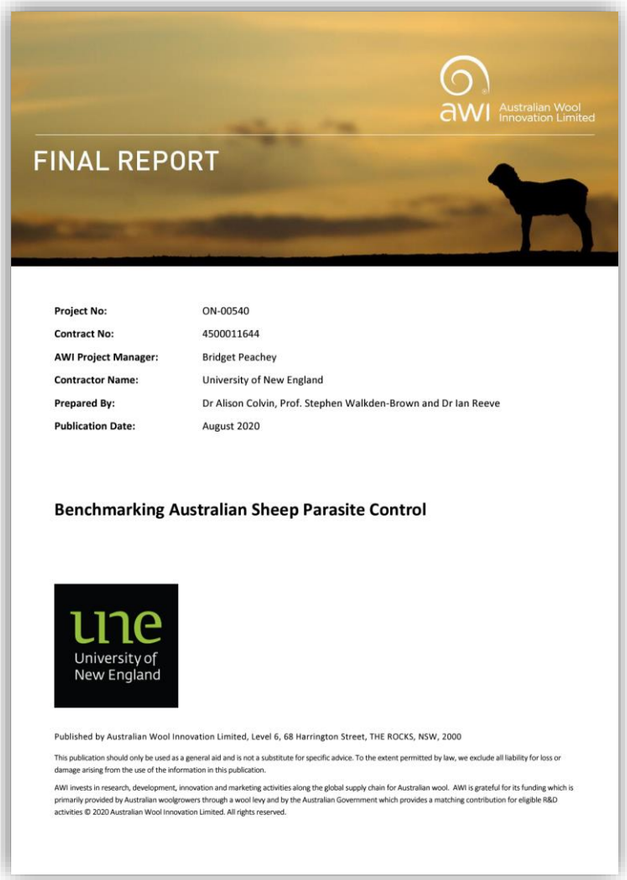




Developed integrated parasite management strategies to minimise the impact of chemical resistance

Modelling of Blowfly Chemical Resistance

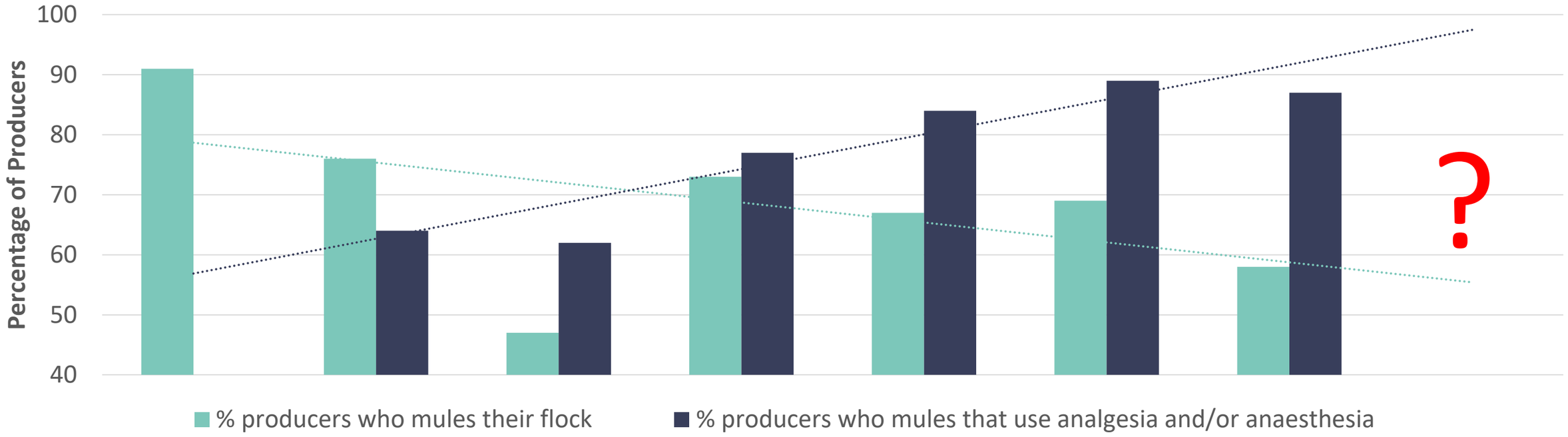
Source: iStock



Demonstrate a 10% increase in adoption of animal welfare practices

NWD Integrity Program | GCC ISO 9001 Certified | AWEX

Change in Mulesing Practice since 2005



YEAR	2005	2010	2011	2013	2017	2019	2020	2021
REPORT	N = 1,290 PHONE	N = 1,000 PHONE	N = 575 ONLINE	N = 580	N = 1,200 CATI	N = 354 ONLINE	N = 1,011 ONLINE & CATI	N = 1,203 ONLINE & CATI
% producers who mules their flock	91%	76%	47%	73%	67%	69%	59%	?
% Producers who mules who use analgesia and/or anaesthesia	N/A	64%	62%	77%	84%	89%	87%	?

AWI Flystrike RD&E Program AVA Audit

"AWI continues to invest in research aimed at decreasing breech strike and specifically to decrease the reliance of wool producers on mulesing."

"This work, while still focused on finding alternatives to mulesing, continues to support much broader sheep welfare outcomes. In this reporting period there is continuing emphasis specifically on vaccine development, and a strong focus on extension of control methodologies."

Professor Bruce Allworth and Dr Graham Lean – April 2022

Full report available on www.wool.com/sheep/welfare/breech-flystrike/progress/

"A number of the projects have resulted in the production of papers for publication in scientific journals and extension articles for sheep producers."

AWI's latest publications on breech flystrike prevention. Click the links below to navigate to the publications in each section.

Flystrike Program Overview | Analgesia and Anaesthesia | Non-Invasive Management Practices | Breeding and Selection

Education, Extension and Promotion | Woolgrower Surveys | Most Recent RD&E Technical Update | Other Publications and Links

It's Fly Time! Resources | Managing Chemical Resistance

www.wool.com/flystrikelatest

http://beyondthebale.wool.com.

2030 Roadmap: Australian Agriculture's Plan for a $100 Billion Industry

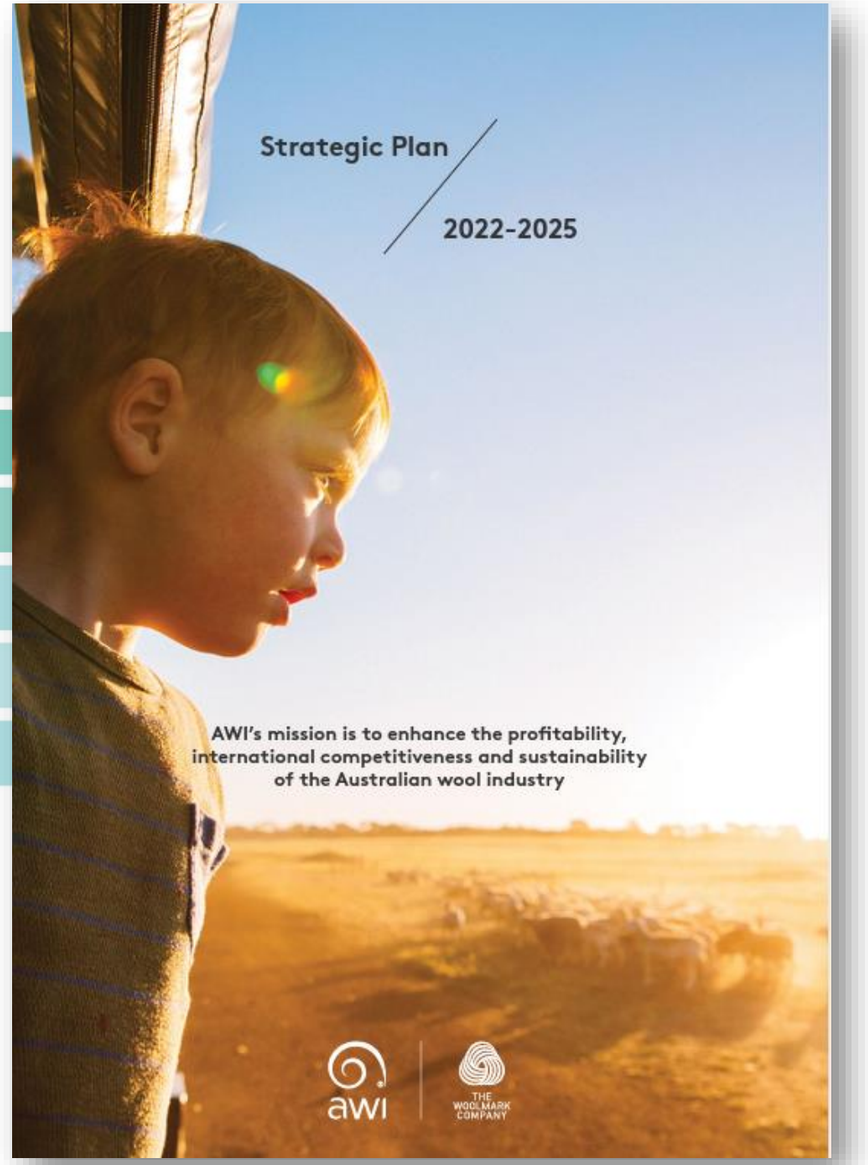
Sheep Sustainability Framework

Agriculture Innovation Australia priorities

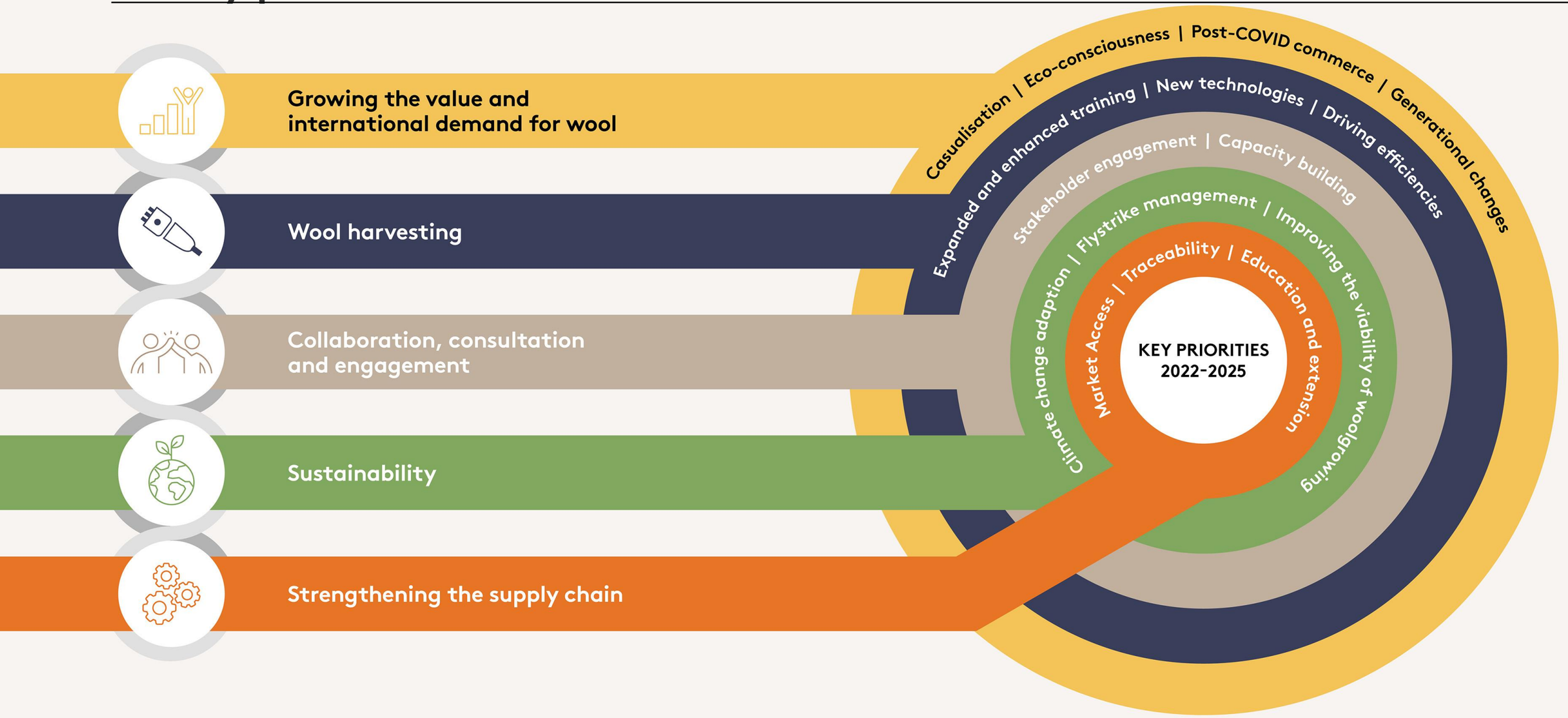
RDC Climate Initiative

Wool 2030 Strategy

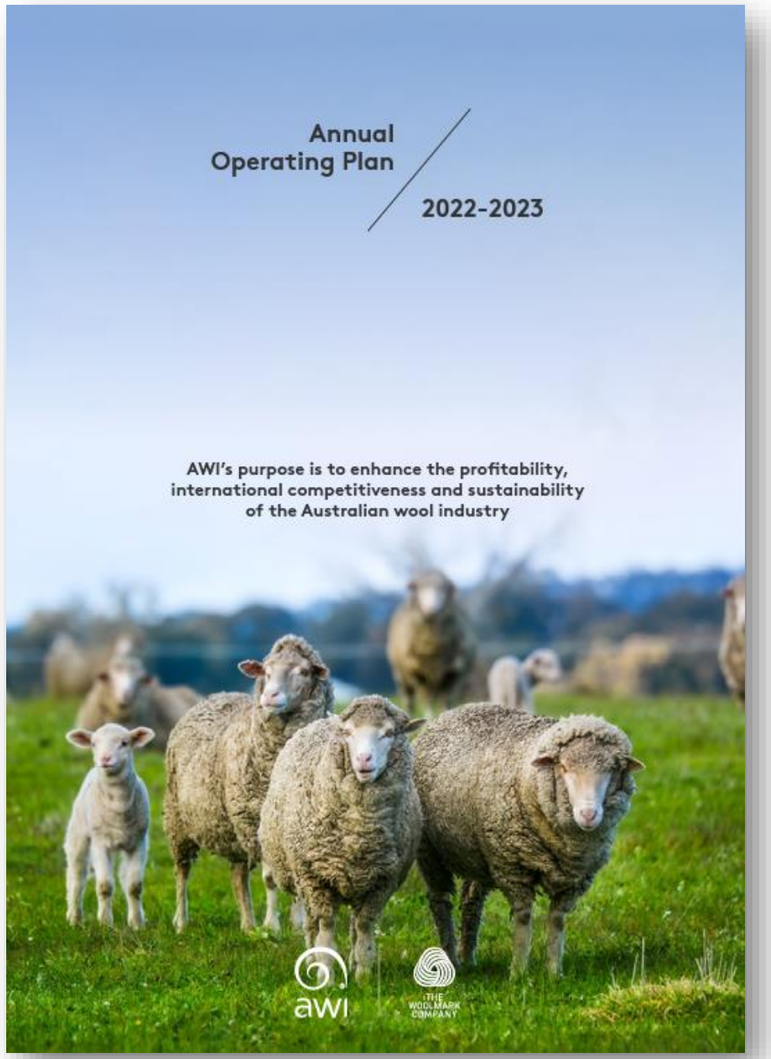
National RD&E Framework



Key priorities 2022-2025



Flystrike Extension Targets for 2022/23



35 woolgrower extension events held on flystrike management knowledge and skills

6 woolgrower extension workshops held on moving to a non-mulesed enterprise

15 advisors trained to assist woolgrowers to move to a non-mulesed enterprise

80 percent increased awareness of tools and confidence to make changes from workshop

AWI FLYSTRIKE EXTENSION PROGRAM

Australian Wool Innovation Limited

Supporting woolgrowers to improve the lifetime welfare of their sheep, reduce their reliance on mulesing, optimise chemical use and increase whole farm profitability, through the provision of practical information and tools and access to accredited advisor support on flystrike management.

TOOLS AND RESOURCES

It's Fly Time!™

Practical, just-in-time information in the lead up to, and during, high-risk flystrike periods

DemystiFly™

Practical information about managing chemical resistance in blowflies

flyboss

Powered by ParaBoss

Information and tools on flystrike management

Breeding and selection

Information and tools to help you breed better sheep

WORKSHOPS AND ADVISOR COACHING AND SUPPORT

SimpliFly™

A one-day workshop to develop a property-specific, strategic flystrike management plan

ClassiFly™

A one-day workshop to increase understanding and skills in breeding for flystrike resistance

StrateFly™

A one-day workshop to develop a property-specific, whole-of-farm strategy for moving to a non-mulesed enterprise

AmpliFly™

One-on-one coaching and support from a trained and accredited advisor to assist you over time to implement your whole-of-farm strategy for moving to a non-mulesed enterprise

Discussion Panel

Where is the future of flystrike RD&E?

Trent Perry - University of Melbourne

Peter James - University of Queensland

Jane Littlejohn - AWI General Manager, Research

Introducing Scott Williams…