



AgriSun Solutions pty ltd

SOUTH AFRICAN RESEARCH PRIORITIES

**Local Validation
Roadmap for
Reflective Orchard
Ground Film**

From International Evidence

1. PURPOSE OF THIS DOCUMENT

International research provides useful evidence that reflective orchard ground covers can alter the light environment within orchards and, in specific crops and cultivars, influence outcomes such as fruit skin colour and canopy light distribution.

However, results obtained in one cultivar, climate or orchard system should not automatically be transferred to another.

South African orchards differ in important ways, including:

- Cultivar mix
- Solar radiation
- Temperature and heat load
- Protective netting systems
- Orchard architecture
- Row orientation
- Canopy density
- Harvest timing
- Production practices
- Commercial grading and export requirements

AgriSun therefore distinguishes between:

WHAT INTERNATIONAL RESEARCH ALREADY TELLS US

and

WHAT STILL REQUIRES SOUTH AFRICAN VALIDATION

The purpose of the AgriSun South African Research Programme is not simply to demonstrate that reflective film “works.”

The objective is to answer specific commercial questions:

Which crops and cultivars respond?

What does the treatment actually change?

When should reflective film be deployed?

Where should it be positioned?

How does orchard architecture affect the response?

How does it interact with South African shade and hail-net systems?

Are there undesirable effects that growers need to manage?

Does any measured response translate into improved commercial grading or pack-out?

2. WHY LOCAL VALIDATION MATTERS

International research gives South African growers a valuable scientific starting point.

It does not automatically provide a South African application programme.

Published research has shown, for example, that reflective ground-cover treatments can influence red skin colour in apples and peaches, and that material placement, orchard architecture and protective netting can affect how reflected light is intercepted by the canopy.

But the response can depend on:

- Crop
- Cultivar
- Orchard system
- Canopy structure
- Reflective material
- Film position
- Application timing
- Climate
- Solar conditions
- Temperature
- Netting
- Fruit exposure

For this reason, AgriSun does not intend to convert an international research result into a universal South African recommendation without appropriate local validation.

3. GOLDEN DELICIOUS

RESEARCH PRIORITY: HIGHEST

Main Research Question

How does reflective ground film interact with fruit-surface temperature, maturity, fruit quality and sunburn risk in Golden Delicious under South African conditions?

Golden Delicious requires a different research approach from red or bi-coloured apple cultivars.

In red cultivars, reflective ground-cover research frequently focuses on improving the light available for red skin-colour development.

Golden Delicious does not have the same production objective.

Fruit may remain on the tree while growers wait for required maturity and soluble-solids specifications, during which exposed fruit can remain vulnerable to solar injury.

AgriSun therefore does not currently recommend treating Golden Delicious as a standard pre-harvest red-colour application.

SOUTH AFRICAN TRIALS SHOULD MEASURE

- Reflected and canopy light
- Fruit-surface temperature
- Ambient temperature
- Fruit exposure
- Existing sunburn at installation
- New sunburn incidence
- Sunburn severity
- Fruit maturity
- Soluble solids / °Brix
- Fruit size
- External peel condition
- Commercial grade
- Pack-out

IMPORTANT RESEARCH QUESTION

A South African trial should establish whether changing orchard-floor reflectivity can modify canopy light **without producing a commercially undesirable fruit-temperature or sunburn response.**

Current AgriSun Position

AgriSun does **not** currently claim that reflective orchard ground film prevents Golden Delicious sunburn.

AgriSun also does **not** claim that reflective ground film necessarily increases Golden Delicious sunburn.

Both questions require appropriate local evaluation.

4. FUJI

RESEARCH PRIORITY: VERY HIGH

Main Research Question

What is the most appropriate pre-harvest application timing for Fuji under South African conditions?

Fuji has direct international reflective orchard-floor research supporting a relationship between reflective ground treatment, anthocyanin accumulation and fruit coloration.

That evidence provides a strong scientific reason to investigate Fuji locally.

It does not establish one universal South African application timing.

SOUTH AFRICAN TRIALS SHOULD INVESTIGATE

- Application timing
- Fuji strain
- Red skin-colour development
- Percentage coloured surface
- Colour within shaded canopy positions
- Reflected light
- Fruit-surface temperature
- Sunburn

- Soluble solids / °Brix
- Firmness
- Maturity
- Commercial grade
- Pack-out

Where Fuji is grown under protective netting, the net system should be recorded and evaluated separately.

5. CRIPPS PINK / PINK LADY®

RESEARCH PRIORITY: VERY HIGH

Main Research Question

Can reflective ground film provide a commercially useful improvement in red/blush colour distribution under South African conditions, and what application timing is appropriate?

Colour is commercially important in Cripps Pink production.

The South African research programme should therefore focus not simply on whether colour changes, but whether the response is sufficient to affect commercial classification.

SOUTH AFRICAN TRIALS SHOULD MEASURE

- Application date
- Days before anticipated harvest
- Starting fruit colour
- Percentage red/blush coverage
- Colour intensity
- Inner-canopy fruit
- Outer-canopy fruit
- Fruit-surface temperature
- Sunburn
- Soluble solids / °Brix
- Firmness
- Starch index where appropriate
- Maturity
- Commercial colour grade
- Pack-out

Key Question

Does the colour response translate into more fruit meeting the required commercial colour specification?

That is more important than simply demonstrating that reflected light increased.

6. FORELLE & ROSEMARIE PEARS

RESEARCH PRIORITY: VERY HIGH

Main Research Question

Can reflective ground film provide a commercially useful blush response in South African Forelle and Rosemarie pears?

South African research involving pear colour and orchard temperature management indicates that cultivar response can differ.

However, relevant South African work involving evaporative cooling should not be presented as reflective-ground-film research.

It instead provides evidence that colour and temperature responses can be cultivar dependent.

For this reason, Forelle and Rosemarie should be investigated separately.

FORELLE — RESEARCH QUESTIONS

- Does reflective ground film influence blush development?
- Which canopy positions respond?
- What application timing is appropriate?
- Does fruit temperature change?
- Is there any change in sunburn or external fruit condition?
- Does the treatment influence commercial pack-out?

ROSEMARIE — RESEARCH QUESTIONS

- Does reflective ground film influence blush development?
- What timing produces the most useful response?
- Does temperature affect the response?

- Do shaded fruit respond differently from exposed fruit?
- Does the response affect commercial grade?

BOTH CULTIVARS SHOULD MEASURE

- Fruit colour
 - Percentage blush
 - Objective colour measurements where available
 - Fruit-surface temperature
 - °Brix
 - Firmness
 - Fruit size
 - Sunburn
 - External defects
 - Commercial grade
 - Pack-out
-

7. NECTARINES

RESEARCH PRIORITY: HIGH

Main Research Question

Which South African nectarine cultivars respond to reflective ground film, and when should the film be deployed?

Reflective ground covers have been included in international stone-fruit research.

However, the available evidence does not justify assigning one application timing to all nectarine cultivars.

South African trials should therefore be cultivar specific.

SOUTH AFRICAN TRIALS SHOULD MEASURE

- Cultivar
- Installation date
- Days before harvest
- Skin colour
- Percentage coloured surface
- Fruit size

- Fruit weight
- Soluble solids / °Brix
- Firmness
- Fruit-surface temperature
- Sunburn
- External defects
- Maturity
- Commercial grade
- Pack-out

Where practical, different deployment timings should be compared with an untreated control.

8. NADORCOTT, TANGO & NOVA

RESEARCH PRIORITY: VERY HIGH

Main Research Question

Does reflective ground film produce a commercially useful rind-colour or canopy-light response in South African mandarin production?

Published Clementine research provides evidence that reflective ground treatment can alter the orchard light and thermal environment and influence rind-colour development under the conditions studied.

That evidence should **not** automatically be transferred to Nadorcott, Tango or Nova.

Each cultivar requires local evaluation.

NADORCOTT

Priority questions:

- Does reflected light increase within relevant canopy positions?
- Does rind-colour development change?
- What timing is appropriate?
- Does fruit-surface temperature change?
- Are there differences in maturity or fruit quality?
- Does commercial pack-out change?

TANGO

Tango should be evaluated as a separate cultivar rather than assuming the Nadorcott response applies.

NOVA

Nova should likewise receive a cultivar-specific trial.

CORE MEASUREMENTS

- Reflected light
 - Canopy position
 - Rind colour
 - Fruit-surface temperature
 - °Brix
 - Acidity
 - Maturity ratio
 - Fruit size
 - Sunburn
 - External rind defects
 - Commercial grade
 - Pack-out
-

9. NAVEL, VALENCIA, MIDKNIGHT & DELTA ORANGES

RESEARCH PRIORITY: HIGH

Main Research Question

Does changing the orchard-floor light environment provide a measurable commercial benefit in South African orange production?

AgriSun currently does not have sufficient cultivar-specific evidence to prescribe one reflective-film application programme across these orange types.

CULTIVARS FOR LOCAL EVALUATION

- Navel cultivars
- Valencia

- Midnight Valencia
- Delta Valencia

SOUTH AFRICAN TRIALS SHOULD MEASURE

- Reflected light
- Light reaching interior fruit
- Rind colour
- Fruit-surface temperature
- Fruit size
- Fruit weight
- Soluble solids / °Brix
- Acidity
- Maturity ratio
- Sunburn
- External defects
- Commercial grade
- Pack-out

Important

An observed response in one orange cultivar should not automatically become a recommendation for another.

10. EUREKA & LISBON LEMONS

RESEARCH PRIORITY: HIGH

Main Research Question

What commercially useful objective, if any, can reflective ground film provide in South African lemon production?

This is an important distinction.

The research question should not begin with the assumption that reflective ground film will increase yield, fruit size or °Brix.

International lemon/Hassaku research has demonstrated changes in the light environment and some fruit-quality characteristics, but did not establish universal improvements in fruit weight, soluble solids or citric acid.

SOUTH AFRICAN TRIALS SHOULD INVESTIGATE

EUREKA

- Reflected light
- Rind condition
- Fruit-surface temperature
- Fruit weight
- Fruit size
- °Brix
- Citric acid
- Maturity
- Sunburn
- External fruit quality
- Pack-out

LISBON

The same core variables should be measured independently.

WHAT NEEDS TO BE ESTABLISHED

- Whether a commercially meaningful response exists
 - What that response is
 - Appropriate timing
 - Appropriate film position
 - Whether cultivar differences exist
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11. MANGOES

RESEARCH PRIORITY: EXPLORATORY / STRATEGIC

Main Research Question

Is reflective orchard ground film commercially useful in South African mango orchards?

Mango should currently be treated as an evidence-development programme rather than an established AgriSun application.

AgriSun should not prescribe a commercial mango timing or performance expectation until stronger direct evidence or suitable local trial data are available.

PRIORITY CULTIVARS

- Tommy Atkins
- Kent
- Keitt
- Sensation
- Heidi
- Shelly

SOUTH AFRICAN TRIALS SHOULD MEASURE

- Reflected PAR
- Canopy light distribution
- Fruit-surface temperature
- Ambient temperature
- Fruit skin colour where commercially relevant
- Sunburn incidence
- Sunburn severity
- Fruit weight
- Fruit size
- Soluble solids / °Brix
- Maturity
- External defects
- Commercial grade
- Pack-out

KEY QUESTIONS

Does reflective ground film meaningfully alter light within the mango canopy?

Does the response differ between cultivars?

Does fruit-surface temperature change?

Does sunburn incidence or severity change?

Is there a commercially useful skin-colour response in relevant cultivars?

Are fruit maturity or quality characteristics affected?

What deployment period, if any, is appropriate?

Current AgriSun Position

Until appropriate evidence is generated, AgriSun should not claim that reflective ground film:

- Improves mango colour
- Increases mango °Brix
- Increases fruit size
- Reduces sunburn
- Advances maturity
- Improves pack-out

These remain research questions.

12. REFLECTIVE FILM UNDER SOUTH AFRICAN SHADE & HAIL NET SYSTEMS

RESEARCH PRIORITY: HIGHEST CROSS- CROP PRIORITY

Main Research Question

How does AgriSun Reflective Orchard Film interact with the specific protective-net systems used in South African orchards?

International apple research has shown that protective netting can alter incoming photosynthetically active radiation (PAR) and that reflective ground covers can alter the amount and distribution of light reflected upward into the canopy.

However, the interaction depends on the orchard system.

South African net types, colours, shading characteristics, orchard architectures and radiation conditions therefore require local evaluation.

RECORD THE NET SYSTEM

- Net colour
- Net material
- Mesh specification
- Stated shading percentage, if known
- Net age
- Net condition
- Height above canopy

RECORD THE ORCHARD

- Crop
- Cultivar
- Row orientation
- Tree height
- Training system
- Canopy density
- Row spacing

LIGHT MEASUREMENTS

Where suitable equipment is available:

- PAR above the net
- PAR below the net
- Reflected PAR above the orchard floor
- PAR within relevant canopy positions

Measurements should record:

- Time
- Date
- Weather
- Measurement position

FRUIT MEASUREMENTS

- Fruit colour
- Fruit-surface temperature
- Sunburn
- Maturity
- Fruit size
- External defects
- Commercial grade
- Pack-out

PRIORITY CULTIVARS

Initial South African under-net work could include:

- Gala
- Fuji
- Cripps Pink / Pink Lady®
- Golden Delicious
- Forelle
- Rosemarie

Important

Reflective ground film and protective netting perform different functions.

AgriSun does **not** position reflective ground film as a replacement for shade or hail netting.

13. CORE SOUTH AFRICAN TRIAL DESIGN

A useful commercial trial requires a meaningful comparison.

BASIC TRIAL

TREATED AREA

AgriSun Reflective Orchard Film.

CONTROL AREA

Comparable trees or rows under normal orchard management without reflective ground film.

TIMING TRIAL

Where the question concerns application timing:

TREATMENT A

Earlier deployment.

TREATMENT B

Later deployment.

CONTROL

No reflective ground film.

UNDER-NET TRIAL

TREATMENT

Protective net + AgriSun.

CONTROL

Comparable protective net without AgriSun.

Trial areas should be as similar as reasonably practical in:

- Cultivar
 - Rootstock
 - Tree age
 - Training system
 - Crop load
 - Irrigation
 - Row orientation
 - Canopy density
 - Orchard management
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14. WHAT SHOULD BE MEASURED?

Not every trial requires every measurement.

The measurements should answer the specific research question.

LIGHT

- PAR
- Reflected PAR
- Canopy position

TEMPERATURE

- Fruit-surface temperature
- Ambient temperature
- Soil temperature where relevant

COLOUR

- Percentage coloured surface
- Colour intensity
- Objective colour measurement where available
- Canopy position

MATURITY & QUALITY

- Soluble solids / °Brix
- Firmness
- Starch index where relevant
- Acidity
- Maturity index

FRUIT SIZE

- Weight
- Diameter
- Commercial size category

DAMAGE / EXTERNAL QUALITY

- Sunburn
- Cracking
- Rind or skin defects
- Other external injury

COMMERCIAL PERFORMANCE

- Grade
 - Pack-out
 - Rejected fruit
 - Reason for downgrade
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15. COMMERCIAL PACK-OUT MATTERS

A biological response is not automatically a commercial benefit.

For example:

Fruit colour may improve while another defect increases.

Or:

Reflected light may increase while °Brix remains unchanged.

A technically measurable response therefore needs to be considered alongside its commercial significance.

Where practical, major AgriSun trials should include commercial grading or pack-out data.

The key question is:

DID THE TREATMENT CHANGE THE PROPORTION OF MARKETABLE FRUIT?

16. RECORD POSITIVE, NEGATIVE AND NULL RESULTS

AgriSun should record all trial outcomes.

POSITIVE RESULT

A measurable favourable response occurred.

NULL RESULT

No meaningful difference was measured between treated and control areas.

MIXED RESULT

One variable improved while another did not.

NEGATIVE RESULT

An undesirable response occurred.

A trial showing no benefit is still useful.

It helps establish where reflective ground film may **not** justify commercial deployment.

17. HOW AGRISUN SHOULD REPORT LOCAL RESULTS

Local commercial results should be described in the context in which they were obtained.

Appropriate wording includes:

“In this commercial trial...”

“Under these orchard conditions...”

“In this cultivar...”

“During the 2026/27 season...”

“The treated area showed...”

Avoid broad statements such as:

“AgriSun always...”

“AgriSun proves...”

“Reflective film guarantees...”

unless sufficient evidence genuinely supports such a conclusion.

18. COMMERCIAL FIELD OBSERVATION VS FORMAL SCIENTIFIC RESEARCH

These should remain clearly distinguished.

COMMERCIAL FIELD OBSERVATION

Useful for:

- Identifying promising applications
- Evaluating practical feasibility
- Developing application programmes
- Identifying potential risks
- Generating future research questions
- Collecting preliminary grower data

Commercial observations can be valuable, but they should not automatically be described as scientific proof.

FORMAL RESEARCH TRIAL

Where AgriSun wants stronger scientific conclusions, an appropriately designed research programme may require:

- Replication
- Randomisation
- Suitable sample size
- Standardised measurement methods
- Appropriate controls
- Statistical analysis
- Documented methodology

Where appropriate, AgriSun should work with qualified horticultural researchers or research institutions.

19. POTENTIAL SOUTH AFRICAN RESEARCH PARTNERS

For strategically important questions, collaboration may be appropriate with:

- Commercial growers
- Horticultural researchers
- Universities
- Fruit-industry research organisations
- Technical advisers
- Packhouses
- Independent horticultural consultants

Formal collaboration would be particularly valuable for:

- Golden Delicious fruit-temperature and sunburn work
- Reflective film beneath South African protective netting

- Citrus cultivar programmes
 - Mango feasibility
 - Cultivar-specific timing trials
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20. PROPOSED RESEARCH PRIORITY ROADMAP

TIER 1 — IMMEDIATE COMMERCIAL VALUE

Golden Delicious

Fruit-temperature / sunburn interaction.

Cripps Pink / Pink Lady®

Local colour response and timing.

Fuji

Local timing and colour response.

Nadorcott

Rind colour, canopy light and timing.

Forelle / Rosemarie

Cultivar-specific blush response and timing.

Reflective Film Under South African Nets

Cross-crop light-management research.

TIER 2 — BUILD CULTIVAR-SPECIFIC GUIDANCE

Nectarines

Cultivar-specific timing.

Midnight / Valencia / Delta

Orange-specific response and timing.

Eureka / Lisbon

Define the commercial objective and timing.

Tango / Nova

Cultivar-specific mandarin validation.

TIER 3 — EXPLORATORY RESEARCH

Mango

Feasibility, timing, light response, temperature, sunburn and quality.

Other Emerging Applications

Only where there is a clearly defined commercial question.

21. WHAT SUCCESS LOOKS LIKE

The purpose of the AgriSun South African Research Programme is **not** to finish every trial with a positive result.

Success means building a reliable local evidence base that helps growers understand:

- Where reflective ground film is useful
- Where it is not useful
- Which cultivars respond
- Which cultivars do not show a commercially meaningful response
- When the film should be deployed
- How it should be positioned
- How netting affects the response
- What risks need to be monitored
- Whether the response changes commercial pack-out

A result showing **no measurable commercial benefit** is useful.

A result showing an **undesirable response** is useful.

Both help prevent inappropriate application.

22. FROM INTERNATIONAL SCIENCE TO SOUTH AFRICAN GUIDANCE

INTERNATIONAL RESEARCH GIVES US THE STARTING POINT

Published research can tell us:

- Which applications have already been investigated
- Which physiological responses are plausible
- Which crops have direct evidence
- Which timing programmes have been tested
- Which variables should be measured
- Which risks have already been identified

SOUTH AFRICAN RESEARCH GIVES US THE NEXT LAYER

Our:

Cultivars

Climate

Solar radiation

Protective-net systems

Orchard architecture

Production practices

Commercial specifications

23. AGRISUN RESEARCH PRINCIPLE

DO NOT START WITH THE ANSWER.

Start with the question.

Create the control.

Record the starting conditions.

Measure the outcome.

Record positive results.

Record negative results.

Record null results.

Repeat where necessary.

THEN DEVELOP THE RECOMMENDATION.

24. IMPORTANT USE NOTICE

This document identifies crops, cultivars and production systems where AgriSun considers South African validation valuable.

Inclusion in this research programme does **not** mean that reflective orchard ground film has already been demonstrated to provide a beneficial commercial response in every listed crop or cultivar.

Some priorities arise from existing international reflective-ground-cover research.

Others arise because an important commercial question remains unanswered.

Until appropriate evidence is generated, experimental applications should remain clearly distinguished from established recommendations.

AGRISUN REFLECTIVE SOLUTIONS

SOUTH AFRICAN RESEARCH PROGRAMME

Better Light. Applied With Evidence.

International science gives us the starting point.

South African research tells us what belongs in a South African orchard.