



ORCHARD MANAGEMENT

Red Carpet Ready: Tools to Improve Apple Blush

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Apple colour development is often a balancing act for Ontario growers. While markets demand strong blush, delaying harvest to enhance colour can increase the risk of quality deterioration during extended storage. This article highlights practical techniques growers can use to improve colour development while maintaining fruit quality for long-term storage. These options include an open canopy and adjusted crop load, reflective fabrics, leaf removal, plant growth regulators and nutrient management.

For use of any colouring method, remember that:

- (i) **timing** is critical for all colouring technologies and
- (ii) **cool nights** are still needed for the success of any colour aid.

Open Canopy & Crop Load

Apple colour is strongly linked to light, meaning a well-lit canopy allows for better blush development. A large contributor to this is an open canopy. High density orchards can be managed in a way that allow for uniform light distribution throughout the tree, although this can be challenging.

Key management practices for an open canopy include the following:

- **Vigour control:** a balance of growth throughout the season is important, but too much growth can lead to overshadowing of fruit and require remediation. Be cognisant of nitrogen applications and knowledgeable of rootstock vigour. Use of plant growth regulators (PGRs) can also aid in vigour management.
- **Narrow canopy:** consider a narrow canopy to improve light penetration in the interior of the tree.

Consider tools (hedging, PGRs) and timings (pruning, hedging, PGRs) to keep the canopy inside of the herbicide strip and row.

- **Renewal limbs:** consistently renewing limbs allows for better light distribution throughout the canopy and encourages younger and more fruitful shoot replacement limbs (limbs aged 2 – 4 years). Different cultivars may require alternate pruning strategies, check out [Shaping Success: The Power of Apple Tree Pruning](#) in 2024 Fall release of ONcore (Vol 28:4) for pruning methods and their influences.
- **Summer pruning:** removal of water sprouts, dense canopy areas and shading near fruit improve light exposure and colour development.
- **Tree height:** tall canopies will shadow limbs below, intercepting most of the available light. Maintain a height that works for your management, cutting back tops annually. Heading the tops of trees can lead to excessive growth, be mindful of the repercussions.

Proper crop load management has also shown to improve colouration indirectly through more efficient resource allocation, fostering a balanced canopy structure (vegetative and reproductive growth) and promoting a more uniform canopy light environment.

The **best option for ideal colouration** is to have an **open canopy** which allows for **even light distribution** and better **light penetration** throughout the tree canopy.

Reflective Materials

Traditionally referred to as reflective ground covers or mulches, these options are more accurately described as reflective materials. They are placed beneath trees and within orchard alleyways to reflect sunlight back into the lower and interior portions of the canopy, improving light distribution to shaded fruit.

These fabrics range in material, which can be woven or film, and colour, typically white, metallic (silver) or a



blend of white and metallic colours.

Impact of Colour

Although colour of the fabric is of the utmost importance, the result of efficacy in the orchard may surprise you.

Silver / Metallic objects are usually noted as the most reflective in terms of light. This is due to the almost mirror-like surface, but issues with using materials this colour in the orchard is not a reflectance problem, but more so a geometry one. While silver or metallic materials can reflect large amounts of light, white reflective materials often provide more effective fruit colour enhancement because they both reflect and diffuse light throughout the canopy. Generally, objects in this colour:

- Showcase high light reflection
- Have concentrated narrow angles of reflected light
- Can generate hotspots and glare

White objects are known to reflect and scatter light. Although light reflectance could be lower in some cases when comparing white objects to silver/metallic objects; in the orchard white has been shown (dependent on the material) to outperform

silver/metallic. Generally, objects that are white:

- Reflect light (potentially at a lower level than silver/metallic)
- Diffuse light in various directions
- Have a more uniform light distribution

Figure 1 highlights the contrasting light reflection characteristics of white fabric and metallic film.

Importance of Placement & Size

With the goal in mind of reflecting light, position and width of the materials play a role in how efficacious a product can be.

There are two options when distributing reflective groundcovers:

- **Row Middle / Alleyway** is the most common deployment method of reflective groundcovers, where fabric is laid between tree rows used for grass cover and machinery traffic (**Figure 2**).

Benefits (+) and challenges (-) of placing reflective fabrics in row middles / alleyways include:

- (+) Large reflective surface
- (+) Easier installation and removal (compared to

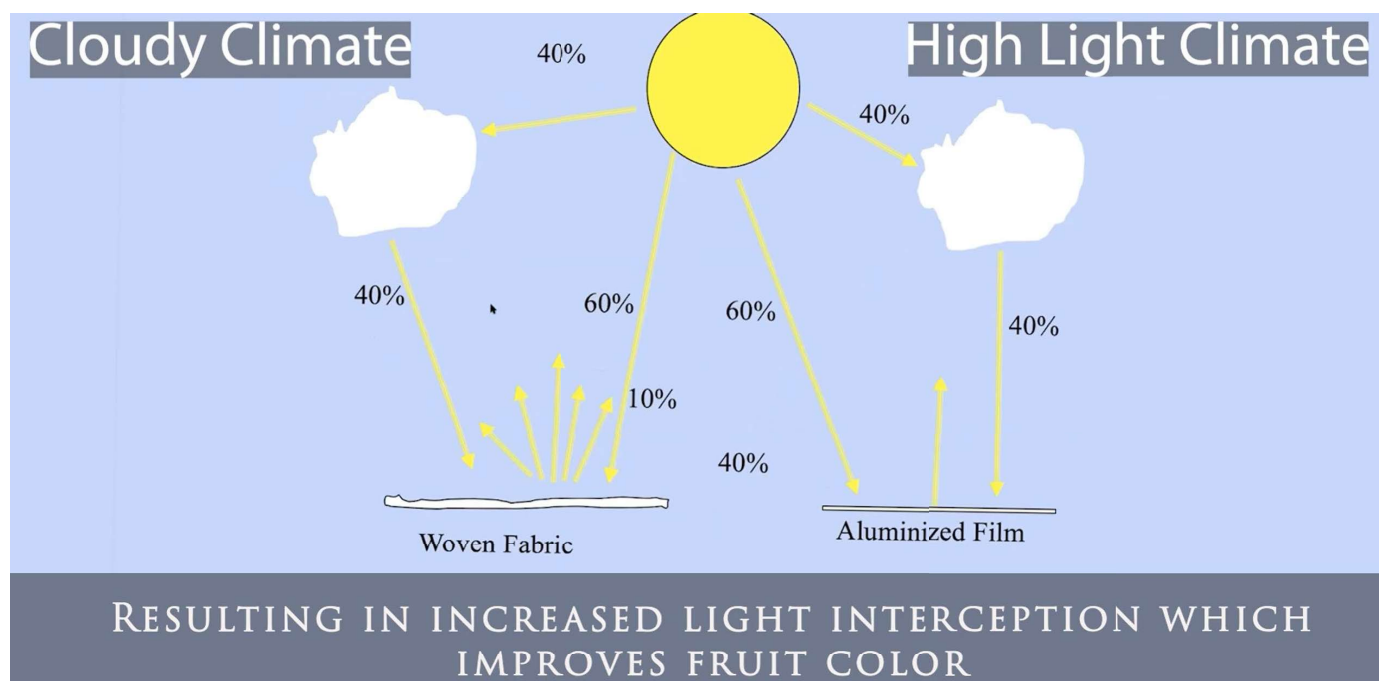


Figure 1. Illustration demonstrating reflection and diffusion of light, in a New York State environment, comparing woven white fabric and aluminized film (Robinson, 2022).



herbicide strip)

- (+) Potentially driveable (depends on product)
- (-) Farther distance from fruit
- (-) Machinery damage from driving
- (-) Grass maintenance
- (-) Labour needed can be considerable
- (-) Storage of materials (especially if reusable)
- (-) Cost can be significant

Herbicide Strip placement involves deploying reflective groundcovers directly beneath the tree canopy (Figure 3). Benefits (+) and challenges (-) of placing reflective fabrics in the herbicide strip include:

- (+) Efficient reflected light
- (+) Potentially less use of material
- (+) Reduced interference with operations (i.e. machinery, platforms, mowers, sprayers)
- (-) Potentially more difficult install
- (-) Irrigation interference and incompatibility
- (-) Risk of debris and moisture accumulation

Another factor to consider is the **width of the reflective fabric** (larger width needed for row middle / alleyway placement). Wider fabrics provide a larger reflective surface area, allowing more sunlight to be intercepted and reflected into the canopy, which can improve overall light distribution and promote more uniform fruit colour development. However, increased width is typically associated with higher material and installation costs, greater storage requirements, and increased exposure to machinery traffic, which may lead to additional cleaning, maintenance, or fabric wear.

Timing of Deployment

Growers in Ontario typically set up their reflective groundcovers 3 weeks to 10 days before harvest.

Types of Reflective Materials

Some materials can be driven over, moved throughout the harvest season to various cultivars, and re-used year after year, while others cannot. Common reflective materials used in apples include (i) white woven reflective fabrics and (ii) metallized plastic films. The



Figure 2. Mylar® recently placed in row middle of Honeycrisp block.



Figure 3. Mylar® placed weeks prior along the herbicide strip of Honeycrisp block.



Table 1. Comparison of common reflective fabrics used in apple orchard systems

Fabric Type	White Woven Reflective Fabrics	Metallized Plastic Films
Definition & Attributes	• Woven polyethylene/ polypropylene blends specific for horticultural use • Durable, reusable and water permeable • Reflect and diffuse light throughout the canopy (Figure 1) • Typically used for multiple seasons	• Thin aluminum-coated polyester/ polyethylene films • Highly reflective, almost mirror-like • Lightweight, shorter-term use • Reflection is directional (Figure 1)
Example(s)	• Extenday® Reflective Fabric • Lumilys® • ColorIt Reflective Cloth • Agritela Riflex, Agritela Lux	• Mylar® film • Extenday® DayBrilliant™, Extenday® Cool ColorUp™ • EasyColor Metalized Reflective Foil
Pros	• Proven improved and most consistent colouration • Durable and reusable • Tolerance of machinery and foot traffic • Proven economic return on high-value cultivars	• Very high reflectivity • Lower initial cost • Lightweight • Simpler deployment (easier install)
Cons	• Higher initial cost • Additional labour required for deployment, movement, removal (anchoring systems) in comparison to films • Storage needed	• Can tear more easily, less reusable • Susceptible to wind damage • Short lifespan • Typically require replacement (not necessarily repairable) • Performance decline with debris

characteristics, advantages, and limitations of both materials are summarized in [Table 1](#).

White woven reflective fabrics have been scientifically proven to have higher light reflectance and consistent fruit colouration in comparison to **metallized plastic films**. This research has been demonstrated in New York and North Carolina over multiple years across various cultivars.

New York studied Extenday® and Mylar® across various tree training systems, showing that Extenday consistently showed higher light interception on sunny and cloudy days compared to Mylar®.

Overall, studies demonstrate that reflective ground covers can improve apple colour development when deployed under conditions conducive to colour formation and with sufficient time before harvest.

Leaf Removal

Another option to improve fruit colouring is leaf pruning and removal, which includes manual and mechanical defoliation.

Timing of the removal of leaves is critical to the success of apple colouration, as removal too soon can

lead to sunburn damage, specifically photo-oxidative sunburn, and removal too late doesn't aid in colouration – resulting in a loss of time and money. For more information on sunburn damage see the article titled ([SPF](#)) [Sun's Pretty Fierce: Understanding and Preventing Light and Heat Stress](#).

Manual leaf removal is when leaves are removed through use of pruners. It is commonly utilized in higher returning cultivars and takes place 2 to 3 weeks before harvest. Leaf pruning can be costly as it is labour intensive, expensive and difficult to time. Although there are challenges, the benefits include more precision and selectiveness based on cultivar and block.

Mechanical leaf defoliation is commonly performed using pneumatic defoliators, this approach follows the same principle as manual leaf removal and is typically reserved for higher-value cultivars where improved colour can increase returns. Pneumatic defoliators are used in lieu of manual leaf removal to reduce labour costs and improve operational efficiency. However, growers should be aware of the higher upfront equipment investment, reduced selectivity compared to hand removal and the potential for leaf and fruit damage.



The timing of these defoliators is also important, often taking place 10 to 8 days before harvest, with strong suggestions to not go earlier than 14 days before harvest.

When using pneumatic defoliators, consider:

- air pressure
- tractor speed
- distance from the tree

These settings should be adjusted to achieve the desired level of defoliation while minimizing leaf and fruit damage.

General recommendations for settings of pneumatic defoliators from the 2022 IFTA Conference include:

- To optimize defoliation, drive as close as possible to the canopy without striking it.
- Use air pressure at 0.7 bar (no higher than 0.8 bar) at 0.6 to 0.7 mph tractor speed.
- Remove up to 50% of the leaves to improve fruit color.
- Do not defoliate earlier than two weeks before harvest.
- Do not defoliate prior to bright sunny days after treatment to avoid photooxidative stress and sunburn.

No matter the leaf removal method, tailor the approach to the cultivar and orchard conditions, as results can differ between blocks.

Researchers based in Italy compared manual pruning, mechanical defoliation and control. They found that leaf removal, no matter the method, improved colour and were comparable in success.

Plant Growth Regulators

Plant growth regulators (PGRs) can be used in 2 different methods to improve colour of apples, indirect and direct. **Direct** methods include products that are specifically developed to enhance fruit colour, where **indirect** methods include products that could improve fruit colour, but are not the primary focus of the

product. Further information regarding products used for fruit colouration can be found in [Table 2](#).

For more product specific information check out the [Crop Protection Hub](#).

Nutrients

Nutrients can support apple colouration through the accumulation of anthocyanins (red pigmentation). Below is a breakdown of nutrients and their roles in colouring:

Potassium (K) is involved in sugar transport which can enhance colouring through anthocyanin synthesis. It is critical that calcium is balanced with potassium for effective fruit colouration – especially due to the risk of bitter pit with high potassium levels.

Phosphorus (P) aids in energy transfer, root and shoot vigour, along with enzyme production – indirectly helping colouration. Foliar applications of phosphorus with magnesium or phosphorus with calcium have shown to aid in apple colouration.

Magnesium (Mg) is critical for chlorophyll and in turn photosynthesis. Magnesium indirectly supports colouring through healthy leaf tissues but is important to keep balanced when encouraging colouration.

Inconsistent and limited evidence has shown that **zinc** and **boron** could be related to colour improvement.

Excessive **nitrogen** inhibits colouration of apples and is well documented.

Avoid using calcium nitrate or chloride foliar sprays in the final 3 weeks leading up to harvest, as they interfere with colouring and leave residue on the fruit skin.

*This article is not intended to be an endorsement or recommendation for a particular product or products but rather a **sharing of information**.*



Table 2. Colour improvement plant growth regulators that apple fruit colour directly and indirectly

Product	Active Ingredient	Role in Colouration	Typical Application Timing	Preharvest Interval (PHI)
Apogee	Prohexadione-calcium	- Indirect - May improve colour through shoot growth reduction and improved light penetration.	- First application when trees have 2.5 – 7.5 cm new growth - Make sequential application(s) 14 – 21 days apart, if required.	45 days
Blush	Prohydrojasmon 5.25%	- Direct - Stimulates anthocyanin (red pigmentation) production.	7 to 28 days before harvest	7 days
Blush 2X	Prohydrojasmon 10%	- Direct - Stimulates anthocyanin (red pigmentation) production.	- First application 28 to 21 days before harvest. - Second application 10 to 7 days before harvest.	7 days
Harvista 1.3 SC	1-methylcyclopropene 1.3%	- Indirect - Extends fruit hang time, allowing longer opportunity for colour development.	- Apply 3 to 21 days before harvest. - Delays maturation by 7 to 14 days.	3 days
Kudos	Prohexadione-calcium	- Indirect - May improve colour through shoot growth reduction and improved light penetration.	- First application when trees have 2.5 – 7.5 cm new growth - Make sequential application(s) 14 – 21 days apart, if required.	45 days
ReTain	Aviglycine hydrochloride 15%	- Indirect - Extends fruit hang time, allowing longer opportunity for colour development.	- Apply 3 to 4 weeks prior for single pick cultivars. - Apply 1 to 2 weeks prior to multiple pick cultivars. - Delays maturation by 7 to 10 days.	7 days

Resources & References

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