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In September-October 2013 similar scientific research has been conducted by pc fruit vzw, located in Sint-Truiden, Belgium. We recommend to read this additional pc fruit report.

Abstract of the Trial report: Light reflection with Lumilys™

Introduction

The use of light reflection textiles in fruit production might help to improve the quality of the harvested fruits, for example the coloration of apples. Many bicolor apple varieties, such as 'Kanzi®' or 'Pinova' need to have best skin coloration, esp. when produced under hail nets.
Lumilys™ is a light reflection textile. It can be used to minimize light loss underneath hail net and probably increase the red color on the surface of the fruits. Therefore the textile has to be spread out underneath the apple trees and to be fixed on the grass in between the tree rows (Picture1).

Aim and experimental design

To validate the effects of the Lumilys™ reflection coverage an experiment was set up using trees of 'Kanzi®'-apples planted under white hailnet. The trees were in the 7th growing year, grafted on the M9 rootstock and planted in a distance of 3,20m x 0,80m (3700 trees/ha). The coverage was placed on the ground the 9th September 2013.
The following experimental design was used: Untreated control – without textile compared to Lumilys™, woven agrotextile.

Picture 1: Lumilys™ with 'Nicoter' apple trees.

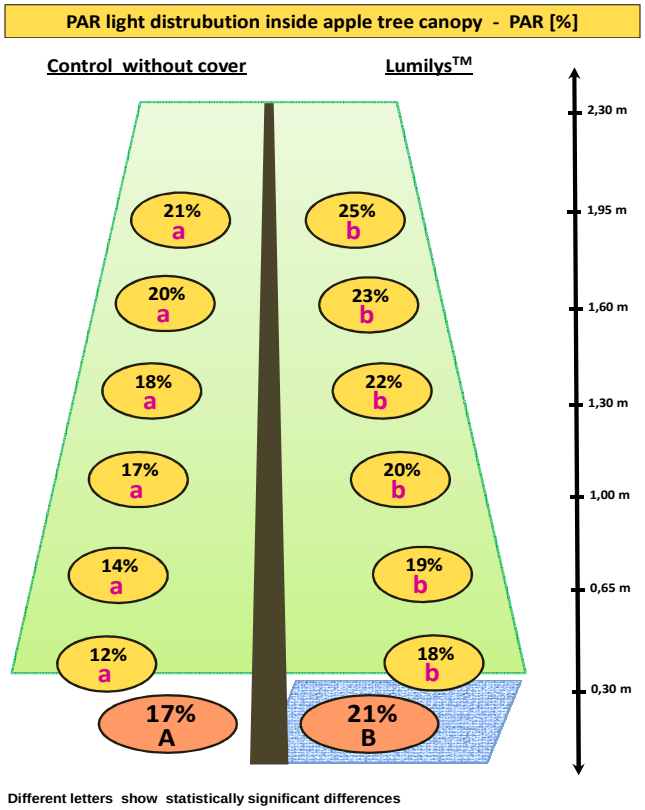
Results

PAR light measurements results

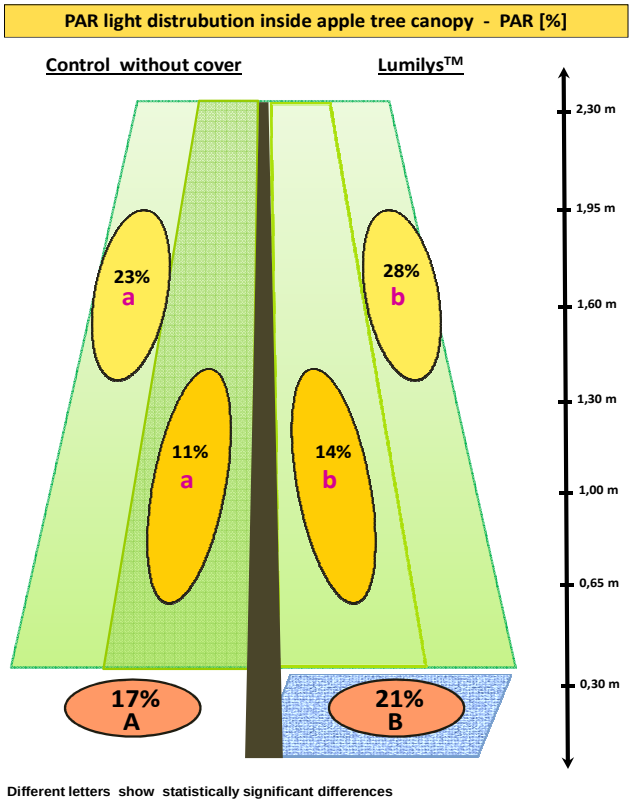
The influence by the light reflecting groundcover Lumilys™ compared to the untreated control can be seen in the pictures 2+3.
Picture 2 shows the vertical PAR light distribution (PAR= **P**hotosyntetically **A**ctive **R**adiation) inside the apple tree canopy. The left half of the painted tree stands for the not on the grass-ground covered apple tree area with a total of 17% PAR available incoming light radiation. The right tree half describes the canopy situation of the trees above the Lumilys™ reflection material with a total of 21% PAR, which is the same as a relative increase of 24%. The difference of 4 % is proven by statistical significance.

Lumilys™ : Lumilys is a registered trademark of Beaulieu Technical Textiles

Although 4% at a first glance seem to be less the real values depend from the incoming radiation and accumulate strongly: for example 150-350 µmol*m^{-2}*sec^{-1} PAR on cloudy days or up to 1200-1500 µmol*m^{-2}*sec^{-1} PAR on sunny days.
Picture 2 compares the available average PAR at different heights above the ground at 30cm, 60cm, 90cm, 120cm, 150cm and 180cm canopy height. The biggest difference (5% PAR) between covered and uncovered grass stripe was at 30cm and 60cm height – the lower levels of the apple tree canopy, where the lack of light is the most dramatic. At each canopy level of the trees above the Lumilys^{TM} coverage there was more usable PAR available for the leafs and their photosynthesis. The higher supply of PAR implies advantages for the trees and their fruits such as better skin color and perhaps internal quality (sugar, taste).



Picture 2: Vertical PAR light distribution



Picture 3: PAR distribution in inner and outer tree canopy

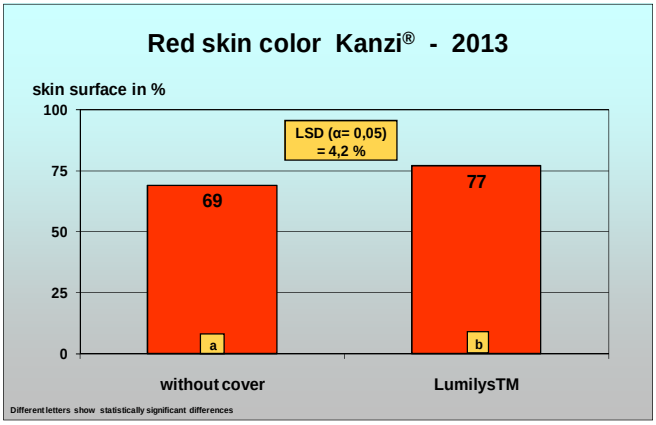
Picture 3 shows the available PAR of the inner canopy volume and the outer part. There was a proofed 5% PAR advantage for the Lumilys^{TM} coverage at the outer canopy and 3% higher PAR inside the tree canopy.

The clear first result is: Lumilys^{TM} textile lead to a significant better PAR distribution in the apple tree canopy. This trial proofed about 4% increase of available PAR compared to the not covered control, equivalent to a relative increase of 24%.

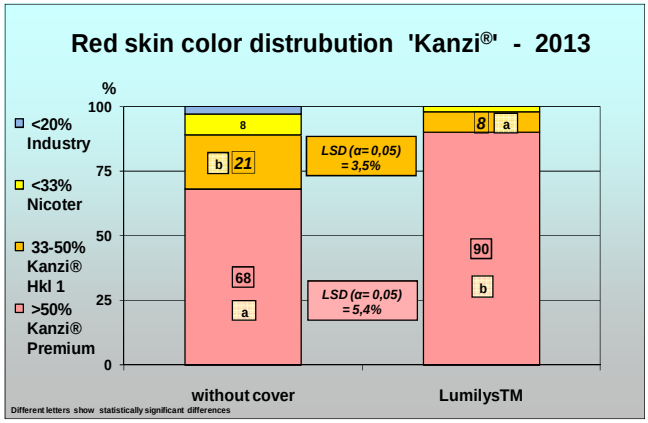
Fruit color and fruit color quality

The fruit color was positively influenced by the Lumilys^{TM} groundcover, because of the better PAR distribution inside the canopy for the last four weeks before harvesting the fruits. The pictures 4+5 show the advantage using the textile with significantly 8 % more red skin surface in general compared to the control (Picture 4), which is the same as a relative increase of 12%.

The improvement of the red fruit color is illustrated with Picture 5. The 'Kanzi®' quality manual claims > 33% red skin surface for real 'Kanzi®' quality.



Picture 4: Improvement of red skin color



Picture 5: Distribution of skin color quality

Less than 33% red color is sold as minor quality and all fruits <20% red surface go to industrial utilization. The trial resulted in 90% fruits with 'Kanzi®' premium color quality when LumilysTM was used. That was significantly more premium color (22%) than without textile or a relative increase of 32%. Added the 8% standard 'Kanzi®' color quality there was 98% 'Kanzi®' color at all compared to 89% 'Kanzi®' color without the coverage.

Discussion

A clear advantage for the red color development was given when using the textile Lumilys™. The covering on the ground with light reflecting textiles is a helpful way to increase fruit coloring within the last 6-4 weeks before harvest. Especially color sensitive apple varieties - such as 'Kanzi®'' or 'Fuji' – might benefit from this technique.

The reflection of radiation increases the PAR distribution inside the tree canopy. This trial reached 4% light increase in general (relative increase of +24%), mainly in the lower and the inner parts of the canopy. The 4% seems not much and on cloudy days with less light interception this might be true. But with sunny skies and hight light interception the accumulating efficacy of 4% higher PAR might become huge.

With a 8% increase of red fruit skin surface in general the positive effect was proved. Especially the good color quality 'Kanzi®' - > 50% red fruit surface – was promoted.

Conclusion

Lumilys™ light reflexion textile enhanced the PAR distribution inside the apple tree canopy. The lower part of the canopy (50-100cm height) profited the most. It was proven that the apple skin surface showed 8% more red color or an relative increase of 12%. The color moved in the high class color segment 'Kanzi®' quality. Overall the Kanzi quality harvest per tree rises from 89% towards 98%, which implies that apples for the industry go down from 11% towards 2%.
The fruit size was not affected.