

Influence of reflective groundcover and biostimulants on fruit colouration on apple fruits

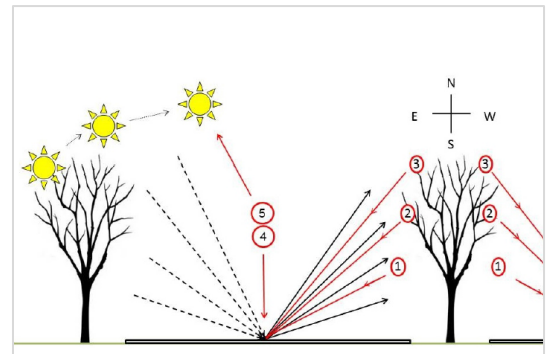
Abbreviated publication of Michael Blanke, Henrike Schuhknecht, Lutz Damerow. Campus Klein-Altendorf, University Bonn, 2016.

Climate change brings about warmer autumn temperatures at the time of colouration viz anthocyanin biosynthesis in the peel of many fleshy fruit crops, including apple, pear, apricot or nectarine fruit. Anthocyanin de-novo biosynthesis is triggered by a combination of light (PAR and UV) and low temperatures or large day-night temperature gradients.

The causes of insufficient fruit colouration hence include less light due to decreasing light intensity, a shorter photoperiod and a lower solar angle in the autumn plus lack of cool temperatures.

Five-year-old apple cv. 'Braeburn Hilwell' trees, grafted on M9 rootstock were employed at the experimental orchard at Campus Klein-Altendorf, University of Bonn (50°N) with a spacing of 3.5 m x 1.3 m. The objective of the study was to improve fruit colouration by both chemical and reflection material.

Hence, two biostimulants were applied twice 5 and 3 weeks before commercial harvest. White reflective groundcover Lumilys® (Beaulieu, Belgium) was spread (3 m wide) on 27 August 2015 in the alleyways on both sides of the tree rows. Two untreated viz unsprayed plots served as control. Each treatment comprised of ten trees with border trees either side.



Light measurements showed a several-fold increase in light reflected from the groundcover Lumilys®, particularly into the lower part of tree canopy. The individual colour measurements on attached fruit showed significantly improved colour (larger a value) of the down-facing side of the apples with reflective groundcover, resulting in a better class I classification and better financial returns.(Figure 1)

At a sunrise angle of maximum 39 ° at the end of September, the light reflection on October 3rd 2015 increased from 0 to 112 $\mu\text{mol PAR m}^{-2} \text{s}^{-1}$ over noon on the east side and 134 $\mu\text{mol PAR}$ on the west side of the tree row (Maximum) and decreased to about 26 $\mu\text{mol PAR m}^{-2} \text{s}^{-1}$ until 17:00. In contrast, the light reflection with woven groundcover was many times higher. Lumilys® reflected up to 616 $\mu\text{mol PARm}^{-2} \text{s}^{-1}$ on the east and 638 μmol on the west side of the tree line. (Figure 2)

Light reflection in parcels with reflectors on the western tree periphery

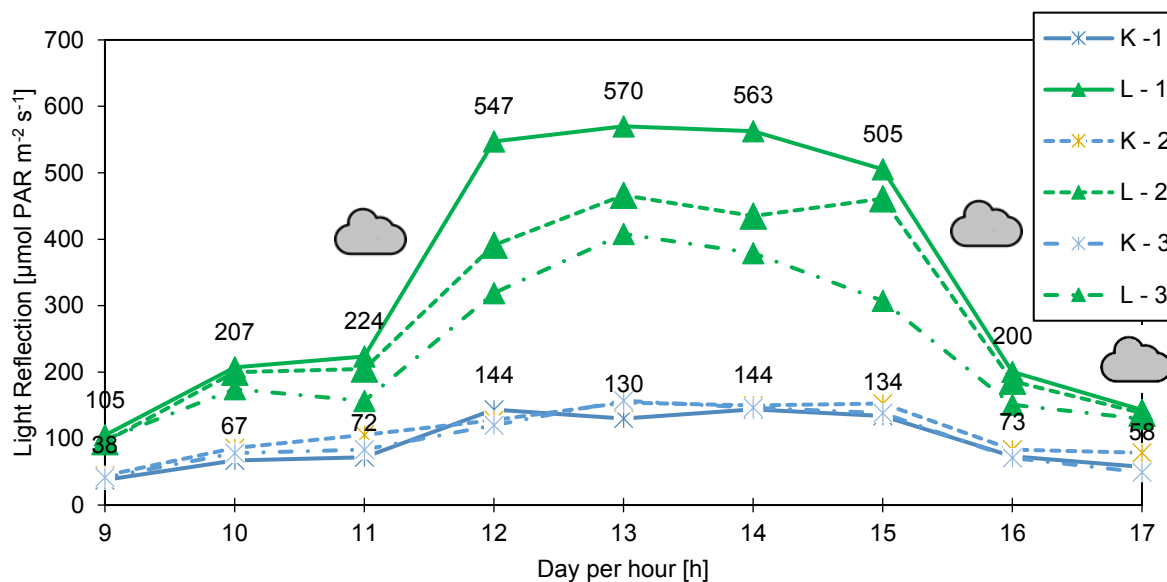


Figure 1 : Day course of the measured light reflection on October 3rd, 2015 (in $\mu\text{mol PAR m}^{-2} \text{s}^{-1}$) on the western tree periphery in three levels on the tree; Abbreviations: K - control; L - Lumilys, 1 - level 1 (height 45 cm / 50 cm from the trunk), 2 - level 2 (height 135 cm / 35 cm from the trunk), 3 - level 3 (height 200 cm / 20 cm from trunk), max 39° sun angle.

Light reflection at 90 ° angle

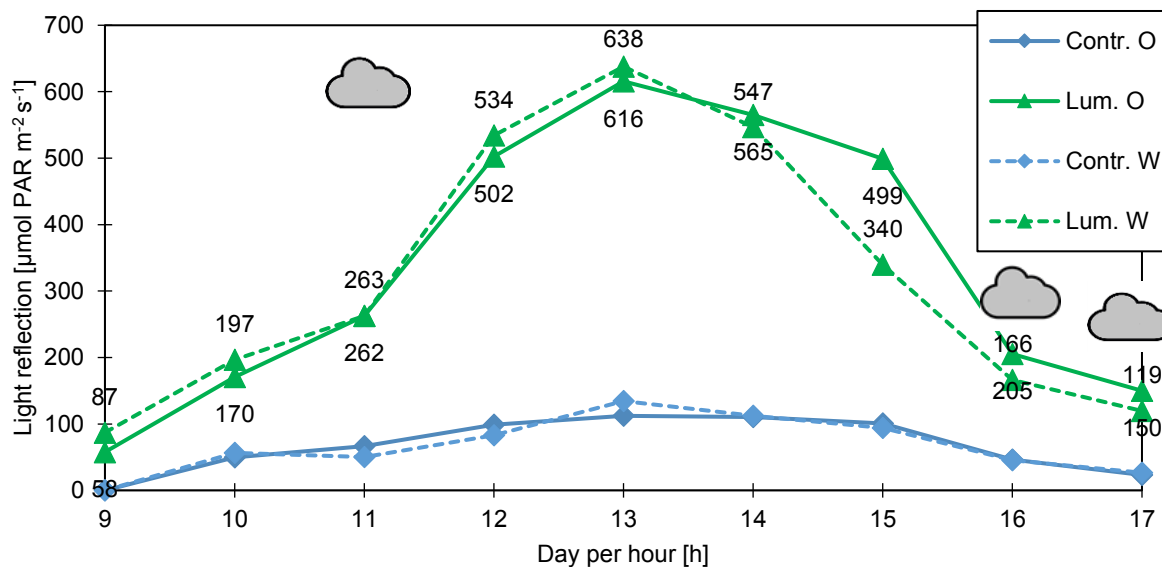


Figure 2 : Light reflection on October 3rd, 2015 in the course of the day from 9 am to 5 pm, sensor vertically downwards to the foil - western and eastern tree perimeter; Abbreviations: Contr. O - Control East, Lum. O - Lumilys East, Contr. W - Control West, Lum. W - Lumilys West

Apple trees with Lumilys® produced 44% well-coloured fruit (with 75%-100% fruit colouration) compared with 16 to 26% in the grassed control. The share of HKL Class I fruits - apples with > 25% red colour – was measured 91,5% in the control, while 4,5% more (96%) was measured with Lumilys®.

Reflective ground covers significantly improved red colouration from 71°hue in the control to 49°hue with the ground cover Lumilys®. The red colouration of the lower surface of fruits improved from 85°hue in the control to 52°hue with Lumilys®.

Fruit colouration per plot (in %)

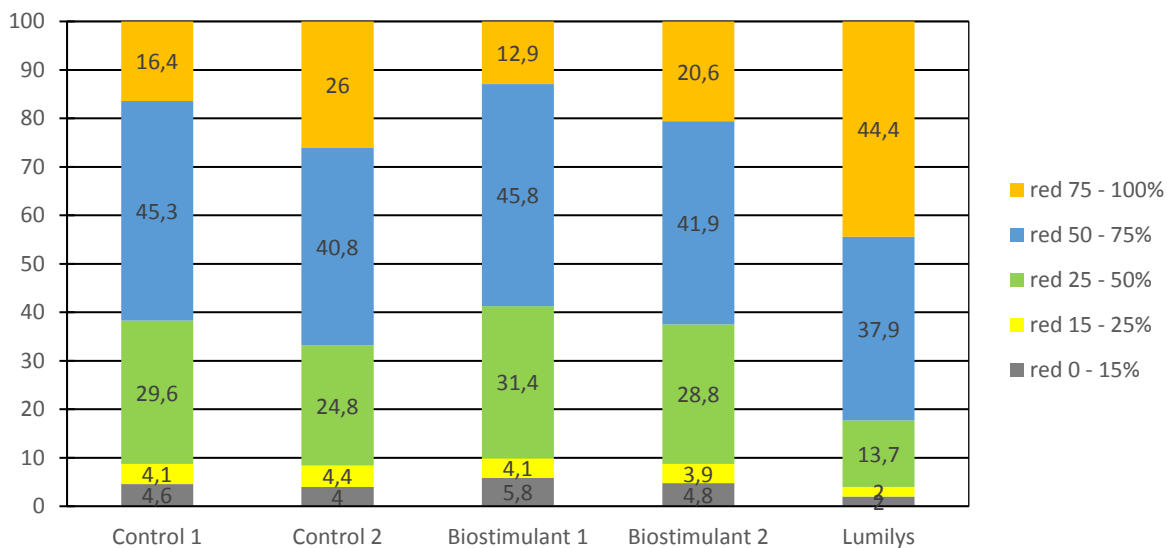


Figure 3 : Fruit colouration per plot and split per percentage of red colouring.

Average hue° colour and chroma values

| Groundcover | Hue° | Hue° below tree | Chroma |
|-------------|------|-----------------|--------|
| Control | 71° | 85° | 31° |
| Lumilys® | 49° | 52° | 30° |

Overall, the experiments showed a major improvement of colouration and sugar with reflective groundcover Lumilys® from Beaulieu Technical Textiles.

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