Title Optical properties of reflection ground covers with potential for enhancing fruit colouration

Author T. Meinhold, J.-P. Richters, L. Damerow and M.M. Blanke

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Abstract

Future technology in horticultural biosystems includes reflective ground covers to improve fruit quality including fruit colouration, firmness and sugar content. Optimal optical properties remain obscure, but it is well-known that visible, particularly red, light as well as UV-B light, enhance colouration of fruits such as apple, peach, grape, plum, kaki and persimmon. The objective of this paper was to examine the reflection of four materials with potential suitability as ground covers (paper, aluminium foil, composite and polypropylene) to aid finding the optimal material for this purpose and its spread area. Spectral reflection (290 nm–800 nm) was recorded in a laboratory over a range of angles of reflectance (5–120° from the ground) as dependent on a range of angles of incidence (30°–60° from the normal) to identify the magnitude of reflection as dependent on wavelength (UV–VIS) and any major reflection angle(s) with the following results: 1) Extenday, a shiny bright white plastic ground cover made for this purpose, reflected diffusely, i.e. uniformly to the same extent, to all angles measured, over 290 nm–800 nm, irrespective of angle of incidence. 2) Uniset O, a matt, white, bio-degradable paper, also reflected diffusely, but *ca.* three-fold less UV at 290 nm–400 nm, than in the visible range up to 700 nm, with a distinct broad peak between 400 nm and 500 nm (blue light), due to the bleach employed in the paper. 3) Mylar, aluminium foil mounted on ultra-thin PE plastic, showed the largest, up to three-fold, reflection of all materials employed over the measured wavelengths (290 nm–800 nm), the magnitude being dependent on angle of incidence, with major reflection at steep angles of 50°–80°, which can hence be classified as a "regular reflector". 4) Svensson ILS Alu, a plastic with interwoven strips of aluminium foil, showed the second-largest light reflection in the UV and visible (including photosynthetically active radiation (PAR)) range as an intermediate "regular reflector" at 60°–80° angles of reflection. Overall, Svensson ILS Alu, Extenday and Mylar reflected evenly over the whole visible/PAR and UV spectrum, whereas the Uniset O reflected less UV than visible light. While three materials (Svensson ILS Alu, Extenday and Uniset O) had suitable angles of reflection for use as ground cover to improve colouration of fruits ca. 1 m above, Mylar appears as a regular reflector.