Objectives & Rationale

Preliminary studies showed that 'Forelle' pear canopy position and TSS relate to mealiness development. This study explored ripening rates, micro-climactic differences (fruit temperature, light interception, and vapour pressure deficit) as well as histological differences of fruit within the canopy in relation to mealiness development. This study further aimed to establish whether pollination influences tissue structure and mealiness development. Position of fruit in the canopy does not only influence mealiness but, also influences blush colour development. The ability of a commercial colour sorting machine to grade 'Forelle' fruit into four colour groups, harvested from four different canopy positions was explored.

Method

Fruit surface temperature and irradiance of five canopy positions were measured. Macro and nano X-ray CT scanning was performed to determine tissue density for fruit on all positions. Fruit of five positions were harvested at optimum and post-optimum maturity and evaluated after storage (8, 12, 16 weeks at -0.5 °C) and ripening (4, 7, 11 days at 20 °C). Flowers of shoulder height were emasculated and hand cross-pollinated with 'Early Bon Chretien' pollen, while others were only emasculated without receiving any pollen. X-ray CT was used to visualise and quantify microstructural differences between pollinated and unpollinated fruit. Maturity indices, ethylene and CO2 production were measured after harvest, cold storage at -0.5 °C and ripening at 20 °C. For the colour sorting trial three colour groups (red, blushed fruit from the middle canopy on the eastern and western sides and green fruit from the inner canopy) were sorted using the Greefa apple colour sorting machine (Greefa, Geldermalsen, NL).

Key Results

Outside canopy fruit were mealier, had the highest surface temperature and percentage irradiance. Inside fruit mealiness remained constant for both harvest maturities regardless of cold storage and ripening times. Maximum mealiness differed for outer canopy sides for various storage and ripening times. The diameter of inside fruit of harvest two did not differ significantly from harvest one outside-east fruit, but outside fruit had a higher mealiness incidence. Hand cross-pollinated fruit was significantly less mealy. Tissue density next to full viable seeds (pollinated) was denser compared to unpollinated fruit parthenocarpic seeds (longer or smaller types). Mealiness was associated with higher fruit porosity and a lower tissue density in the neck. Cell histological differences show that the outer canopy west fruit had the lowest connectivity of the pore space, while the inside canopy fruit had the highest pore connectivity. The commercial apple colour sorter did not accurately detect the three blush colour groups, however blush colour did relate to mealiness incidence.

Conclusion/Discussion

Outside canopy, fruit had the highest surface temperature, sunlight exposure and mealiness. Mealiness may not be linked to ripening rate as ethylene levels of inside fruit were in many cases higher and yet, did not get as mealy as the outside fruit. Thus, canopy position seems

to play a larger role in mealiness development. Cross-pollination resulted in lower mealiness incidence and lower porosity. A commercial colour sorter that can view the pear blush from all angles designed for pears would improve sorting accuracy.