Fruit growth, cuticle deposition, water uptake, and fruit cracking in jostaberry, gooseberry, and black currant

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ABSTRACT

Fruit cracking after rain limits the production of a number of crops, including some *Ribes* species. To gain a better understanding of the factors involved in cracking, fruit growth, deposition of the cuticular membrane (CM), water uptake and fruit cracking were studied in black currant (*Ribes nigrum* L. cv. Zema), gooseberry (*Ribes uva-crispa* L. cv. Rote Triumph), and jostaberry (*Ribes nidigrolaria* B. cv. Jostine). Fruit surface area and fresh mass increased continuously throughout development, whereas deposition of the CM was biphasic. CM mass per fruit increased rapidly up to 42, 41, and 49 days after full bloom (DAFB) in black currant, gooseberry, and jostaberry, respectively. Thereafter, CM mass per fruit remained constant in gooseberry and jostaberry or increased at a lower rate in black currant. The cessation of or reduced rate of CM deposition resulted in a decrease in CM mass per unit area in all berries. Elastic strain of the CM at maturity averaged 23.8% and 19.5% in gooseberry and jostaberry, respectively, and only 8.2% in black currant. Microcracks in the CM were observed first in gooseberry and jostaberry 64 DAFB, whereas there were no microcracks in black currant. Water uptake into mature detached berries was linear over 2 h of incubation. Rates of uptake were highest in gooseberry followed by black currant and jostaberry. Relative uptake was similar via the cut end of the pedicel (32.1%), the apex of the fruit (34.7%) and the fruit surface (33.2%). Rates of water uptake through the fruit surface were positively related to surface area. Average fruit water potential for black currant, gooseberry, and jostaberry was -2.14 ± 0.17, -1.24 ± 0.03, and -1.89 ± 0.20 MPa, while the permeability for osmotic water uptake was $7.7 \pm 0.4 \times 10^{-8}$, $5.2 \pm 0.1 \times 10^{-8}$, and $3.3 \pm 0.3 \times 10^{-8}$ m s^{-1}. Incubating whole fruit in deionized water for 72 h resulted in more cracked jostaberries (94%) than black currants (74%) or gooseberries (50%). A comparison of our findings in *Ribes* berries with published data for the sweet cherry drupe revealed that the berries fitted the relationships established in sweet cherry among fruit growth, cuticle deposition, strain of the cuticle, microcracking, permeability for osmotic water uptake, frequency of stomata and cracking. The *Ribes* berries were less susceptible to cracking than sweet cherry.