

Title Cropping effects on the loss of apple fruit firmness during storage: The relationship between texture retention and fruit dry matter concentration

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Abstract

Firmness is a primary measure of apple fruit texture, the key determinant of eating quality of apples. Despite the well developed understanding of the process of firmness loss in storage, there is very limited information concerning pre-harvest and at-harvest causes of the variation in fruit quality in the marketplace. The objective of the present study was to investigate the respective roles that the factors of time and intensity of crop thinning, fruit size and fruit dry matter concentration (DMC) each may have in determining fruit firmness of 'Royal Gala' apple at harvest and during storage. Loss of firmness during storage of all thinning treatments and of fruit size and DMC categories was described by a bilinear equation. Time of thinning did not influence any aspect of fruit softening during air storage at 0.5 °C. Comparing the crop loads, a lower crop load (100 fruit per tree) resulted in firmer fruit at harvest. The loss of firmness during storage associated with crop load occurred because fruit from the lowest crop load softened more rapidly during the second slow phase of softening. Fruit firmness was positively correlated with fruit size where larger fruit were slightly firmer than smaller fruit at harvest but not after storage. The softening profiles of different sized fruit were similar except for a class of extremely small fruit, which appeared to soften more rapidly during the second slow softening phase of storage. Both at-harvest and post-harvest fruit firmness were influenced by fruit DMC. Fruit firmness at harvest increased significantly as fruit DMC increased from 13% to above 16%. Despite having significantly different initial firmness, all fruit classes with DMC higher than 13% softened at a similar rate during both the initial rapid and second slow softening phases and the transition between the two phases occurred after the same time in storage. In contrast, fruit with very low DMC, less than 13%, had a greater rate of softening in the second phase. These results indicate that variation in fruit firmness at harvest and after storage is influenced by processes that affect and alter fruit DMC during fruit development. In this respect crop load control, which is used to improve fruit size, was also an important factor in altering fruit DMC, thereby affecting firmness at harvest and after storage. Furthermore, the effects of DMC on fruit firmness were independent of fruit size.