

Using multilevel systematic sampling to study apple fruit (*Malus domestica* Borkh.) quality and its variability at the orchard scale - DTU Orbit (09/11/2017)

Using multilevel systematic sampling to study apple fruit (*Malus domestica* Borkh.) quality and its variability at the orchard scale

We report on the performance of a novel sampling method for determining fruit quality variability and yield from an orchard, which focus on its applicability for the fruit industry. We used the 'fractionator' tree sampling method to investigate the quality variability of a small, representative sample of 'Granny Smith' (*Malus x domestica* cv. 'Granny Smith') apples obtained from a 17 ha orchard based on a final sample of 74 fruit. Estimates of fruit marketable yield and fruit size distribution agreed well with packing house records. The estimated marketable yield was 356.6 ± 89.2 t compared to 374.9 t of fruit packed for export. Distributions of starch (S), soluble solids content (SSC) and flesh firmness (F) were also estimated from the sample. The distribution of starch (S) and fruit mass (M) showed high variability ($CVS = SD/mean = 0.32$ and $CVM = 0.23$), whereas SSC and flesh firmness showed moderate variability ($CVSSC = 0.11$ and $CVF = 0.10$). The average within-tree variabilities were estimated as $CVM = 0.04$, $CVSSC = 0.10$, $CVS = 0.15$ and $CVF = 0.07$. Between-tree variabilities were similar to the within-tree variabilities, except for starch ($CVtM = 0.04$, $CVtSSC = 0.13$, $CVtS = 0.29$ and $CVtF = 0.09$). From the quality characteristics studied only fruit mass could be significantly related to position of the fruit in the canopy, represented by height of the fruit above ground, the fruit position along the branch and position relative to the tree row orientation in the orchard. Variations in starch, SSC and flesh firmness could not be explained by position of the fruit in the canopy. The methods used in this paper are proposed as tools for studies aimed at understanding sources of quality variability as well as for management purposes. Further research is needed to determine recommended sample sizes to accurately describe the distribution of various quality variables of apples at the orchard scale.

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