Title Prediction of blood orange MT firmness by multivariate modelling of low alterative penetrometric data set: A preliminary study

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Abstract

A study was conducted to evaluate a non-destructive method able to predict Magness–Taylor (MT) penetrometric firmness of blood oranges, potentially applicable for on-line selection. The method consisted of multivariate modelling of non-destructive penetrometric measurements performed on intact oranges with a 11.3 mm diameter probe by digital dynamometric equipment. The tests were carried out on 366 blood oranges (*Citrus sinensis* (L.) Osbeck cv. Tarocco); 60 were used as a control group to verify the non-destructive nature of the tests. Four test factors were used on the fruit: two different levels of non-destructive deformation (1 and 3 mm), at two different deformation speeds (5 and 30 mm s^{-1}). In order to obtain the reference parameter (MT firmness), a destructive penetrometric test followed each non-destructive deformation on the same fruit (deformation of 20 mm at 1 mm s^{-1}). The force–deformation curves of the non-destructive tests were elaborated to calculate different texture parameters (max force, elasticity, work). These parameters with raw curve data (force values for constant deformation steps) were used, after autoscaling pre-processing, as X-block datasets in supervised multivariate modelling (partial least squares) to predict MT firmness values. Among the test factors used, the 30 mm s^{-1} speed and 3 mm deformation provided the best overall prediction of MT firmness. This comprised an *r* value of 0.76 and standard error of prevision (SEP) of 2.99 N for a MT firmness mean value of 35.65 N (8.4%). The time needed to apply the selected deformation may lead to a sorting speed of about 10 fruit per second, representing an acceptable value for commercial application.