Abstract

Although the developmental physiology of the Apple tree has been studied intensively, little research has been done on developing non-destructive techniques to study stress during the growing season. In an orchard it is necessary to detect problems (pre-harvest) early in the growing season in order to guarantee a good quality product with a good storage potential. The objective of this thesis was to investigate whether our portable chlorophyll fluorescence imaging system can be used to detect different types of stress during the pre- and post-harvest period on apple trees.

The capability of the fluorescence imaging system to determine fruit maturity and quality at harvest and hereby predicting the storage potential was assessed. Differences between chemical treatments influencing the fruit ripening process, harvest date and fruit sides could be detected with fluorescence imaging. The colour could be predicted with a high correlation based on the maximal fluorescence intensity determined with the FIS.

Post-harvest or pre-harvest application of ethylene has a profound effect on the physiology of the fruit indicated by changes in the fluorescence pattern. Image analysis was done during 14 consecutive days after post-harvest ethylene application and a remarkable pattern became clear.

Drought stress can be an important problem in some fruit producing areas. Visual differences in the growing pattern of the trees are observed. No effect of treatment was found on the fluorescence-imaging pattern of apples harvested at different harvest dates. Apparently, trees are highly adaptive to environmental stresses.

Another type of pre-harvest stress, magnesium deficiency was studied with chlorophyll fluorescence imaging on the apple variety Idared. Leaves were analysed during two consecutive years but no changes in fluorescence are observed. The effect of magnesium deficiency on apple quality was studies but no changes were found.

Apple trees of the cultivar Jonagold "Novajo" and Golden Delicious "Smoothee" were infected with respectively a leaf virus (ACLSV) and a fruit virus (Russet Wart) to study whether the FIS is able to detect infection before visual symptoms appear on either leaves or fruit. Apparently, the ACLSV is could not be detected with the parameters that are used presently. Russet Wart infection

affects clearly the chlorophyll fluorescence of apples. Further research is necessary to understand the pattern of infection and find the causal agent.

At this moment, the system is ready to be used as a predictor for fruit maturity and storage potential. Further research is necessary to investigate the application for detecting prolonged stress conditions.