The impact of climate change on fruit growing and fruit quality

[1]Martina Skendrović Babojelić, [1]Goran Fruk, [1]Rea Vrtodušić, [1]Ana-Marija Antolković [2]Bojan Šarkanj, [3]Tihomir Kovač, [3]Ana-Marija Gotal, [3]Lidija Jakobek, [3]Ante Lončarić

[1]*University of Zagreb Faculty of Agriculture, Department of Pomology, Svetošimunska 25, 10000 Zagreb, Croatia*
[2]*University Centre Koprivnica, University North, Department of Food Technology, Trg dr. Žarka Dolinara 1, 48000 Koprivnica, Croatia;*
[3]*Faculty of Food Technology Osijek, Josip Juraj Strossmayer University of Osijek, Franje Kuhača 20, HR 31000 Osijek, Croatia*

Correspondence: rvrtodusic@agr.hr; Tel.: +385-1-2394-070

Introduction

Climate change has become a major problem that is having a negative impact on food production, especially on the yield and quality of fruit. Climate change is causing disruptions linked to the dormancy of fruit species, early flowering, the occurrence of various disasters (frost, drought, hail, floods) and numerous other stress factors that have a negative impact on fruit species.

The aim of this paper

➡ is to analyse the consequences of climate change for fruit production and to emphasise the importance of adapting cultivars and cultivation in order to achieve stable yields and better fruit quality.

Figure 1. Appearance of cherry and apple blossoms after low temperatures

Figure 2. Apple blossom - frozen and undamaged pistil - normal petals

Figure 3. Frost ring on an apple fruit

With the occurrence of frost, prolonged drought, and extremely high temperatures at the time of growth and ripening, fruits are irregular in shape, size, and colour, which undermines fruit quality as an important indicator of market value. In addition to external quality, unfavourable factors also affect biochemical processes that lead to changes in the chemical and nutritional composition of the fruit.

In addition to high temperatures and lack of precipitation, frost and hail are the most serious damage to fruit crops. The low temperatures of late spring frosts have a bad effect on physiological processes in plants, especially in the flowering stage (Figure 1 and 2). Fruit physiology first slows down and then is completely interrupted by freezing of water in parts of the plant at a temperature of 0°C (Figure 3). Late spring frosts can cause major economic damage in orchards.

Hailstorms can vary in intensity, duration, and the timing of their occurrence during the growing season. The damage depends on how ripe the fruit was and how large and hard the hail was that hit it. This damage can includes hredded leaves, broken or damaged shoots and wounds to scaffold branches, fruit damage, and even fruit that has fallen to the ground. A hard impact early in the season could cause fruit deformation. Later damage may look more like bruising. Major hail damage (Figure 4) will affect fruit grading and most will end up in the second and third grade category or destined for industrial processing. Prolonged high temperatures and sun exposure also cause damage in the form of browning or necrosis of the fruit (Figure 5) .

Figure 4. Consequences of hail on apple fruit

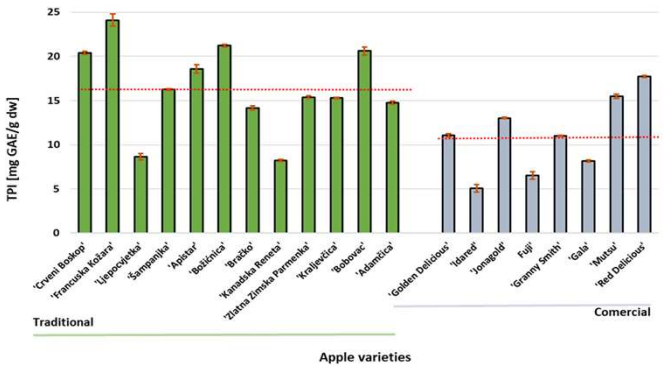

Figure 6. Polyphenol content in traditional and commercial apple cultivars

Previous research suggests that traditional apple cultivars are more tolerant of the adverse effects of climatic factors. Their fruits also contain several polyphenols (Figure 6), suggesting that they are adapted to the adverse effects of abiotic and biotic factors. Due to their high quality chemical and nutritional composition, these cultivars represent a potential for cultivation and processing.

Figure 5. Browning and necrosis of apple fruit from due to sun and high temperatures

Conclusion

For this reason, it is important for fruit growers to choose suitable locations and cultivars to be adapted to the requirements of fruit species, and to apply appropriate technologies and systems to protect against natural disasters, in order to make fruit production more cost-effective and fruit quality better.

Only with such a comprehensive approach can the negative effects of climate change be mitigated.

Funding: This work has been supported by Croatian Science Foundation under the project "The possibility of exploiting traditional apple cultivars for the production of apples and apple juice with the reduced patulin content" (UIP-2020-02-8461).