

IMPACT OF CLIMATE CHANGE ON APPLE PRODUCTION, IN IAȘI REGION

IMPACTUL SCHIMBĂRILOR CLIMATICE ASUPRA PRODUCȚIEI DE MERE, ÎN ZONA IAȘI

ZLATI Cristina¹, ISTRATE M.¹, DASCĂLU M.¹, PAȘCU Roxana^{1*}

*Corresponding author e-mail: ing.dr.roxana@gmail.com

Abstract. *Horticulture is strongly dependent on climate and in the context of climate change is being affected by climate change in terms of quantitative and qualitative yield reduction. In Europe, Mediterranean region and Middle Eastern Europe are the most affected by global climate change in the recent years. High temperatures in the orchard during summer and autumn can affect fruit quality. Lately, more symptoms occur, as sunburn damage, poor blush development, water core, rapid fruit ripening and reduced fruit growth.*

Some studies were carried out on apple under Iași-Copou ecological conditions to see the effects of high temperatures and how these high temperatures could affect apple quality.

All these changes will determine us to adapt orchard practices to manage the impacts that an increased frequency of heat events will have on fruit quality.

Key words: climate change, variety, fruit quality, production.

Rezumat. *Horticultura este dependentă de climă și, în contextul schimbărilor climatice, este afectată de schimbările climatice în ceea ce privește reducerea producțiilor sub aspect cantitativ dar mai ales calitativ. În Europa, regiunea Mediteraneană și Europa de Est sunt cele mai afectate de schimbările climatice globale din ultimii ani. Temperaturile ridicate din timpul verii și toamnei pot afecta calitatea fructelor. În ultimul timp, apar mai multe simptome, cum ar fi deteriorări datorate de arsurile solare, colorație incompletă, fenomenul de sticlozitate, maturarea rapidă a fructelor și creșterea redusă a fructelor.*

În acest sens, au fost efectuate unele studii la măr, în condițiile ecologice Iași-Copou pentru a vedea efectele temperaturilor ridicate și modul în care aceste temperaturi ridicate ar putea afecta calitatea fructelor.

Toate aceste schimbări ne vor determina să adaptăm practicile din plantație pentru a gestiona impactul pe care îl pot avea temperaturilor ridicate asupra calității fructelor.

Cuvinte cheie: schimbare climatică, soi, calitatea fructelor, producție.

INTRODUCTION

Although rising global average temperature is sometimes called “global warming”, climate change includes not only a change in average temperature, but also changes in various aspects of the weather, such as wind types, the amount and type of rainfall, and the type and frequency of extreme weather events. In fact, the term “global climate change” describes more clearly the situation we face

¹Iași University of Life Sciences, Romania

(Blanke and Kunz, 2011). Climate change is a serious problem, as both the natural and socio-economic systems are sensitive to climate change, and the magnitude and speed projected for them will have a significant impact, which will threaten the sustainability of these systems (Niranjan *et al.*, 2016).

Agriculture, with all its segments, is the most sensitive to climate of all the branches of economy. It is estimated that if atmospheric carbon dioxide reaches twice as high as pre-industrial concentrations - which is expected to happen by the middle of the 21st century if no precautions are taken - the overall average production of cultivated plants will remain approximately the same (Vujadinović *et al.*, 2012). However, changes in the layout of climate and vegetation areas to higher latitudes and altitudes will require considerable regional adaptations, especially in transition areas. In arid areas of the Earth, the risk of malnutrition is likely to increase, as adaptation needs, such as crop change, irrigation and land use, are not met. Growth periods for some crops will be shortened by three to four weeks in some areas, but will increase in others. Both the harvest period and the periods corresponding to the individual stages of crop development will change (Warrington *et al.*, 1999).

MATERIAL AND METHOD

This study was conducted to assess the situation of the production sector regarding the effect of climate change. All these changes can help us develop in the future strategies for adaptation to these climate changes and will also cause us to adapt the practices in the plantation, in order to manage the impact that high temperatures have on the production and quality of apples.

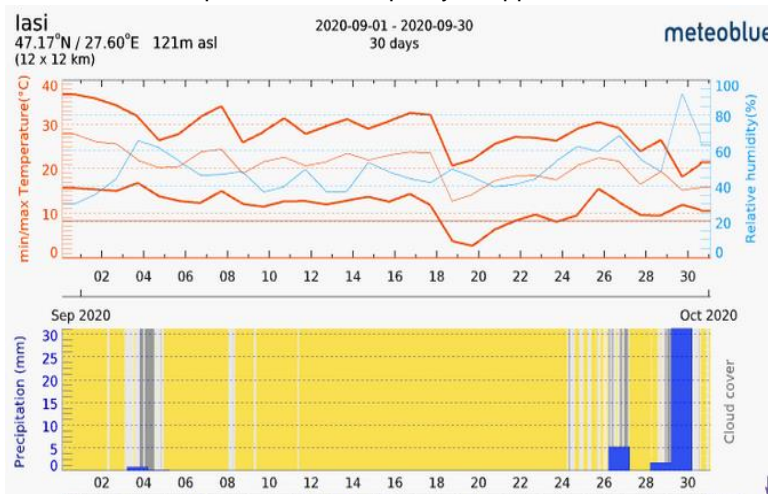


Fig. 1 Dynamics of air temperature, relative humidity and precipitation, recorded in Iasi, September 2020 (<https://www.meteoblue.com>)

There was conducted some studies on the apple culture, in the ecological conditions of Iași-Copou, in order to fully understand the effects of climate change and how they affect the quality of fruits. The study was conducted in Iași, V. Adamache didactic-experimental farm, that owns 4.14 ha apple culture. Data for the study were collected using both qualitative and quantitative methods.

Both phenological, production and climatic data (fig. 1) on evolution were recorded.

In table 1 there are registered phenological data of fruiting phenophases. Comparing with previous date we could observe a advance flowering by 3 days, comparative with the previous decade.

Table 1

The development of fruiting phenophases at the apple varieties present in the plantation, data for 2020

Variety	Swelling of the buds	Budding	Beginning of flowering	End of flowering	Duration of flowering (days)	No of days from the end of flowering to harvest
'Golden delicious'	12.04	19.04	25.04	04.05	9	140
'Florina'	11.04	18.04	23.04	03.05	10	151
'Idared'	11.04	19.04	22.04	01.05	9	162
'Generos'	10.04	17.04	24.05	05.05	11	148

RESULTS AND DISCUSSIONS

Models that describe relationships between plant behavior and temperature are a useful way of understanding how warming temperatures might affect apple culture (Kunz and Blanke, 2011).

There is scientific evidence that the agricultural and food system across the world is experiencing climatic change (Parry *et al.*, 2000; Jones and Brennan, 2009). Horticulture, an aspect of agriculture, is no doubt being affected by climate change in terms of yield reduction.

This study was conducted to assess the perception of apple farmers about the effect of climate change and the various adaptation strategies they are using.

Horticulture is undoubtedly affected by climate change in terms of the decrease in economic yield in terms of quantity but especially in terms of quality.

In Europe, the Mediterranean region and Eastern Europe are the most affected by global climate change in recent years (Roberts, 2002).

The quality of the fruit is affected to the greatest extent by the high temperatures in summer and autumn, cumulated with the effect of lack of precipitation. Lately, symptoms appear more and more often, such as: decalation of fruiting phenophases, russetting (fig. 2), damage due to sunburn (fig. 3), incomplete

staining, cracks on the fruits (fig. 4), the phenomenon of glassiness, accelerated ripening of fruits, unevenness of fruits and their reduced growth (fig. 5).



Fig. 2 Presence of rust on fruits on a high percentage



Fig. 3 Sun burns



Fig. 4 Fruit cracks due to drought

A very present phenomenon was the large percentage of cracked fruits, approximately 65%, a phenomenon triggered in the context of heavy rainfall that occurred after a long period of drought.

It was also noticed the unevenness of the fruits on the tree. These phenomena have implications not only on the production but also on the storage capacity of the fruit.

The results of global research conclude that changes in the structure of climatic and vegetation areas at higher latitudes and altitudes will require considerable regional adaptations, especially in transition areas.

Changes in the layout of climate and vegetation areas to higher latitudes and altitudes will require considerable regional adaptations, especially in transition areas.

Growth periods for some crops will be shortened by two to three weeks in some areas, but will increase in others. Both the harvest period and the periods corresponding to the individual stages of crop development will change (Kuden, 2020).

The analysis of the climate change and its impact studies significantly contribute to the future strategic planning in economic and production

development, and thereby must be done with high level of confidence, which considers cooperative work of the climate research, producers and user community (Adebisi-Adelani and Oyesola, 2013).



Fig. 5 Uneven weight of the fruits

CONCLUSIONS

This study drove us to the following conclusions:

1. It is vital to transform information in relevant knowledge which could be used to create databases containing complete information about this phenomenon.
2. Climate change may bring a shift in apple culture zoning. This new zoning could help growers in colder regions but in the same time disadvantage the fruit growers in traditional areas.
3. Monitoring orchard climate and tree performance will improve growers' capacity to understand and manage the impacts of a changing climate.
4. Elaboration of appropriate integrated plans for cultural management adopting new technologies in risk areas.

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