Mini Review
Open Access
CrossMark

Managing citrus orchards under climate change

Abstract

Citrus occupies the third position in fruit crop production worldwide after grapes and apple, while, citrus ranking the first position in world trading. Citrus fruits one of the popular fruits globally for their taste and flavor, currently there is more interested in citrus fruit consumption particularly under the COVID-19 pandemic due to higher Vitamin C content. Citrus are growing in warm climates from tropical to arid conditions in a wide range of temperatures ranging from 10˚C to 35˚C, while, Mediterranean climate is considered the most proper climate for citrus growth and productivity. Citrus has three or four growth cycle depending on climate conditions and water availability, Generally, vegetative growth starts with warm weather up to 12.8˚C and growth increase continuously with increasing temperature up to 35˚C, while, growth decline with rising temperature more than 35˚C. Due to harsh climate conditions, there is a fluctuation in citrus production and annually drastic yield loss, because of rising temperature and water shortage, which causes weakening growth, flowering, and productivity of citrus.

Keywords: citrus, climate change, rising temperature, tree productivity

Volume 6 Issue 2 - 2021

Waleed Fouad Abobatta
Citrus Research Department, Horticulture Research Institute-Agriculture Research Center, Egypt

Correspondence: Dr. Waleed Fouad Abobatta, Horticulture research Institute, Agriculture Research Center, Egypt, Email wabobatta@yahoo.com

Received: March 17, 2021 | **Published:** April 16, 2021

Orchard management

There are different steps required to maintain citrus (*Citrus spp.*) orchards productivity under climate change conditions include using proper management practices that include providing a suitable form of the nutrients with adequate requirement and maintain soil moisture,[1] also, application of nutrients like Calcium, Potassium, Boron, and Manganese, adapt tree behavior under stress through controlled stomata conductivity under heat/high-temperature stress, it stimulates plant metabolisms processing to kept tissues with adequate water potential, that increase plant tolerant for the rising temperature, as well as the use of macroelements particularly Nitrogen, Potassium, Calcium, and Magnesium minimize the injuries of Reactive oxygen solutes.[2] Using proper rootstocks tolerant for drought and heat stress like *Citrus limonia (*Rangpur lime), and *Citrus jambhiri* Lush. (Rough lemon), minimizing the adverse effects of rising temperature, drought, and salinity stresses,[3] and other biotic and abiotic stresses, increasing tree growth and production. Well as Plant growth regulators like cytokinins (CK), abscisic acid (ABA), salicylic acid (SA), Jasmonic acid (JA), and Proline, could play a significant role in increase citrus tree tolerating abiotic stress,[4] therefore, exogenous treatment of plant growth substances enhancing leaf content of chlorophyll and improve water potential, and increases the productivity of citrus trees. Using proper agricultural practice, exogenous application of plant growth regulators, with tolerant rootstocks could play a significant role in the sustained production of citrus under harsh climate conditions.[5]

Rising temperature and citrus flowering

In the North hemisphere flowering initiation start from mid of December till the mid of January, chilling requirement of citrus is lower, so, the temperature under 15˚C in winter proper to produce enough flower to gain economic yield, while, warm nights during this period affect negatively on type of inflorescences and flowering rate consequently productivity.[6] In general, the air and soil temperature affects the longevity of flowering and the rate of flowering, also, low air temperature (15˚C) produce more flower number and leafless flower shoots than higher temperature. Furthermore, there is a significant effect of temperature on the flowering period, also, heat-waves during flowering and fruit set increase abortion a lot of flowers and new fruit set which reduce total yield, and reduce fruit quality.

Temperature requirement of the citrus tree

Citrus grows between (10 to 35˚C), vegetative growth starts at 12.8˚C), while, the optimum growth of citrus fruits is between (25-30˚C), due (30˚C) considered the optimum conditions for photosynthesis and dry matter production which increase trees vigor and productivity, then, growth increases with rising temperature up to 35˚C, while the growth gradually decreases with the increase in temperature and almost stopped when it reaches (49.5˚C), although, main branches died at 51.5˚C (Figure 1).

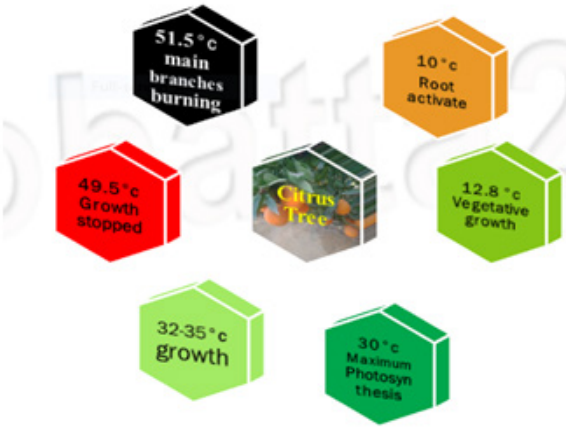

Figure 1 Schematic for the effect of temperature on citrus growth.

Cold temperature

Citrus trees did not tolerate cold conditions or frost, while, they can withstand low temperatures up to 3˚C for a short period, furthermore, flower and new shoots burning under cold temperature up to (-1.7˚C), the low temperature below (-6˚C) leads to burning trees.

Soil moisture

Citrus water requirements ranging from 8000–10000m^3/ha/yearly depending on different factors like climate conditions, soil, growth stage…etc. the fluctuation in soil moisture affect negatively on growth and productivity of citrus, there are various negative effects of long drought period on the citrus tree including dropping flowers and new

fruit set, also, new flushes and main branches are affected by drought conditions.

Furthermore, citrus non-tolerant crop for soil flooding, therefore waterlogging for longtime causes various injury for the citrus tree,[7] therefore, excessive irrigation particularly under clay soil conditions affects negatively citrus growth (Figure 2).

Fig.2. Field Image for excessive irrigation mistakes (Photo by Dr. Abobatta 2019).

Figure 2 Field image for excessive irrigation mistakes.[6]

Also, increases susceptibility to various pathogens infestation like fungal diseases like root rot and Phytophthora, which is considered a soil-borne fungus that spreading quickly under high soil moisture conditions and infects susceptible species with Gummosis disease that reducing yield 10-30% approximately.[8]

Salinity

Due to reducing rainfall as a result of climate change, salinity increasing particularly in arid and semi-arid regions, citrus considered a sensitive crop for salinity, so, high salinity disturbed growth and productivity of citrus, hence, application of soil conditioners,[9] Arbuscular mycorrhizal,[10] and proper fertilizers could minimizing the hazards of salinity and improve citrus productivity.

Conclusion

Due to harsh climate conditions, there are negative effects on the growth and production of citrus spp., worldwide, which causes reducing yield, high temperature and drought considered the most affected factors on citrus orchards, it's reducing vegetative growth, abortion fruit set, and increase fruit dropping before harvesting.

Therefore, under these climate conditions, citrus orchards need to modify the agricultural practice to proper time with physiologically processing in the tree, exogenous application of biostimulant, and using Arbuscular mycorrhizal as soil application could have a significant role in improving citrus vigor and yield crop under improper climate conditions.

Acknowledgments

None.

Funding

None.

Conflicts of interest

The authors declare that there is no conflict of interest.

References

1. Abobatta WF. Challenges for Citrus Production in Egypt. *Acta Scientific Agriculture.* 2018;2(8(:40–41.
2. Syvertsen JP, Garcia-Sanchez F. Multiple abiotic stresses occurring with salinity stress in citrus. *Environmental and Experimental Botany*. 2014;103:128–137.
3. Cimen B, Yesiloglu T. Rootstock breeding for abiotic stress tolerance in citrus. *Abiotic and Biotic Stress in Plants-Recent Advances and Future Perspectives*. IntechOpen; 2016.
4. Iqbal N, Fatma M, Khan NA, et al. Regulatory role of proline in heat stress tolerance: modulation by salicylic acid. *Plant Signaling Molecules.* 2019:437–448.
5. Ilyas M, Nisar M, Khan N, et al. Drought tolerance strategies in plants: A mechanistic approach. *Journal of Plant Growth Regulation*. 2020:1–19.
6. Abobatta WF. Influence of climate change on citrus growth and productivity (effect of temperature). *Adv Agri Tech Plant Sciences*. 2019;2(4):180036.
7. Li H. Citrus tree abiotic and biotic stress and implication of simulation and modeling tools in tree management. *Tree and Forestry Science and Biotechnology*. 2009;3 (Special Issue 1):66–78.
8. Mounde LG, Ateka EM, Kihurani AW, et al. Occurrence and distribution of citrus gummosis (*Phytophthora spp*.) in Kenya. *African Journal of Horticultural Science*. 2009;2:56–68.
9. Abobatta WF, Khalifa SM. Influence of hydrogel composites soil conditioner on navel orange growth and productivity. *J Agri Horti Res*. 2019;2(2):1–6.
10. Khali HA, Eissa AM, El-Shazly SM, et al. Improved growth of salinity stressed citrus after inoculation with mycorrhizal fungi. *Scientia horticulturae.* 2011;130(3):624–632.