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ASSESSING PEACH FARMERS TECHNICAL PRODUCTION VULNERABILITIES AND THEIR PERCEPTION TO CLIMATE CHANGE

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ABSTRACT

This study was carried out to investigate technical production vulnerabilities among professional groups related to peach farming in Greece under extreme biotic and abiotic environmental exposures. Peach technical productivity under a wide variety of physiological type of stresses coupled with applied farming practices and raw environmental data were taken into account. Interviews on a structured questionnaire and farmer workshops were used for data collection. Most of peach farmers understand that extreme temperature as the core problem of climate change; however, few of them realize that traditional knowledge could be used to alleviate extreme environmental conditions effect. Furthermore, very few of them use internet tools in order to find resilient and climate change resistance peach varieties. Potential use of genetic modified peach trees was found by the farmers as a resilient strategy to support their income and their local agri-food industrial networks respectively.

INTRODUCTION

Peach fruit is a very important trade commodity worldwide, fulfilling logistics in raw food consumption, processed food, pharmaceutical and beauty industrial sector (Engindeniz et al. 2003; Seo et al. 2020; Tsvakirai and Mosikari 2020). All these lines must remain sustainably open at any cost, no matter whatever environmental conditions peach tree meets in the field (Citadin et al. 2014). Stressful environmental conditions are multiparametric in real time; efforts to mitigate climate change effects are consistent by the global agricultural community (Elbehri et al. 2011). Recorded physiological changes on peach trees due to climate change include: a) delayed winter endodormancy break, earlier blooming and ripening due to suboptimum and extreme temperature b) fruit drop, skin streaking, bronzing, wrinkling and collapse close to maturity related to consecutive extreme rainfalls c) cascade alterations in peach tree photosynthetic rate and metabolic regulation caused by environmentally induced dehydration and d) smaller fruit size due to high spring temperatures (Jiménez et al. 2020; Lopez et al. 2007; Pantelidis et al. 2021; Parker and Abatzoglou 2019; Vanali et. al. 2021). In order to provide counter climate change, sustainable solutions for global peach production, genomic basis of the tree must be examined through functional resilient approaches (Li et al. 2021). Selected indices for global warming, acidification, terrestrial eutrophication, depletion of fossil resources, depletion of phosphate and potash resources shown that peach fruit orchards positively contribute to the phenomenon which can get worse in high

density farming practices (Barreto et al. 2020; Ferreira et al. 2018). Farmer's perception is very important to manage and alleviate the phenomenon; therefore their opinion was analyzed in this work.

MATERIALS AND METHODS

Study area: The study area, Giannitsa Pella is located in the northern part of Macedonia Region in Greece (40°47'42.15"N, 22°24'56.10"E). It was selected for study due to its major and diachronic contribution to national peach production in Greece (Kukurjannis 1985). Temperature, wind and precipitation information was obtained according to the climate bulletins of the Hellenic National Meteorological Service Data Center for the full area of Pella (http://www.hnms.gr/emy/en/climatology/climatology_month) and local farming meteological network data of Gannitsa Pella GR, collected and analyzed by National Observatory of Athens (https://www.noa.gr/en/, https://www.meteo.gr, https://www.meteofarm.gr/). In Giannitsa Pella's farming area the annual average temperature, annual maximum temperature, and annual minimum temperature were 16,3°C, 22,9°C, and 10,6°C respectively. The annual average, maximum and minimum monthly rainfall was 31.9mm, 102.6mm and 1.0mm respectively. Many authors and institutes (Bank of Greece 2011; Drogoudi et al. 2017; Kambezidis et al. 2021) mention that in last 10 years extreme climate change conditions affect horticultural crops in the experimental area.

Questionnaire: The survey explores: a) which – according to farmer's perception- is the most severe consequence of climate change for peach orchards, and if b1) the traditional farming knowledge is capable to alleviate effects of the phenomenon b2) the farmer used direct communication and / or internet tools to find peach resistant varieties and rootstocks to climate change b3) agrees to use genetically modified peach trees, resistant to climate change for food security purposes. Furthermore, farmer's vision is recorded in the context of changes in labor costs, farmer's mobility, provisions for career shift and changes in contract farming with peach processing industrial sector due to climate change.

Data analysis: The collected data were tabulated and statistically analyzed for interpretation. Descriptive statistics were used to characterize farmer perceptions on climate change as well various adaptation measures followed by farmers.

RESULTS AND DISCUSSION

Peach farmers consider extreme temperatures as the most critical climate change threat for their orchards; water availability appears to be a yield loss factor; however, environmental temperature changes seem to be a dominant issue. Increase of CO_2 greenhouse gases is a relative concern but farmers do not consider wind as a potential environmental risk which affects peach tree productivity.

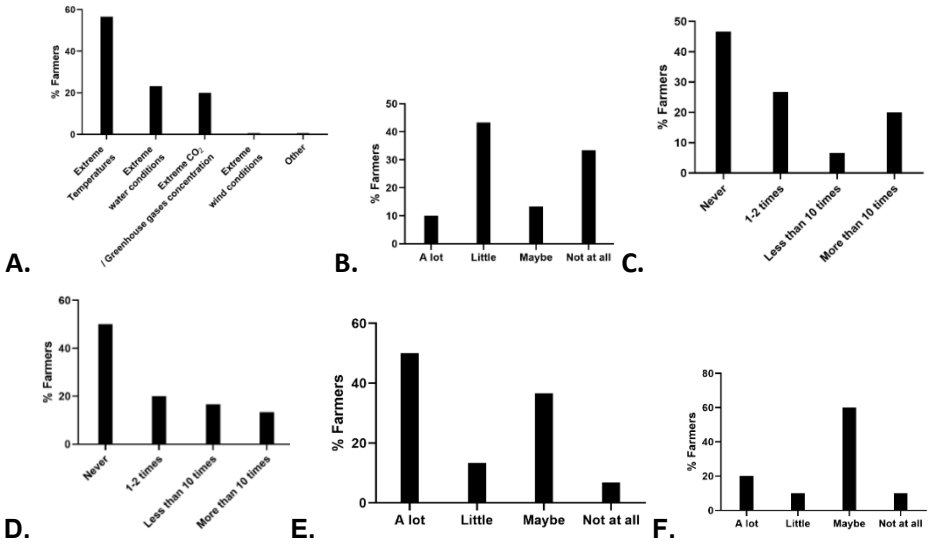

Fig 1: Farmer's perception on most Important climate change effect to peach production (a), traditional farming knowledge as tool to help climate change alleviation effects (b), internet tools use to find climate change peach resistant varieties and rootstocks (c), direct communication use with suppliers to find peach climate change resistant varieties and rootstocks (d), use of genetically modified peach trees resistant to climate change for food security reasons (e) and the potential of increased labor costs in peach production process due to climate change (f).

Table 1

Peach farmer's mobility choices due to climate change

	Farmer's choice order (%)					
	1st	2nd	3rd	4th	5th	6th
No farmer mobility and use of peach resistant varieties / rootstocks	13,3	23,3	30	16,6	16,6	0,0
Rural mobility and/or immigration process	20	20,0	6,6	20	43, 3	0,0
No farmer mobility; change crop	53,3	20,0	13,3	3,3	10,0	0,0
No farmer mobility; change land use	6,6	23,3	30	23,3	16,6	0,0
No farmer mobility; change profession	6,6	23,3	20	36,6	13,3	0,0
Other	0,0	0,0	0,0	0,0	0,0	0,0

Table 2

Peach farmer's perception for how peach based industry is going to behave under long term climate change effects

	Farmer's choice order (%)		
	1st	2nd	3rd
Industrial facilities are going to move to another place	26,6	73,3	0,0
Changes in peach logistic chain without moving facilities to another place	73,3	26,6	0,0
Non envisioned changes by the farmer	0,0	0,0	0,0

The biggest challenge, after peach tree domestication for intense farming purposes, is to provide resilient technical and organizational solutions to climate change (The international peach genome initiative et al. 2013). Pangenomic pooled analysis of close wild peach tree relatives with domesticated peach genome for reproductive phenology could provide useful solutions to counteract climate change effects (Cao et al. 2020; Li et al. 2021; Romieu et al. 2014). Under increased CO_2 and drought in peach tree rootstocks decrease shoot/root dry weight ratio, which is common in many plant species (Jiménez et al. 2020). Furthermore, water insufficiency increases costs not only for irrigation purposes but also for preservation of soil fertility (Boretti and Rosa 2019).

In general, online communication for climate change consists a solid tool to alleviate consequences; however this tools seems to be more in use by NGOs, politicians and less from rural and geographically isolated groups where such topics of discussion must be introduced in a segmented structure at local scale (Morrison et al. 2017; Schäfer 2012). Herein, climate change communication deficit seems to not be an apparent issue as a whole but further open discussions concerning peach farmer interactions with other professional groups is recommended to initiate.

Overall perception of climate change impact in farming areas varies; it is heavily related to the type of crops which provide farmer's income and it is due to education, mass media exposure, gender, age, beliefs, values and type of land tenure of the peach orchard (Jena and Dibiat 2020; Quan and Dyer 2008). Glocal peach farmer partnerships with integrate environmental and social competitive thinking will be helpful and capable not only to provide higher yields in extreme soil and climate conditions but also sustain fresh product input for food industry (Mishenin et al. 2021).

Conventional and new breeding tools for peach trees are capable to provide resilient and synchronized developmental growth with seasonal phenotypes under extreme climate stress conditions (Cirilli et al. 2021). In our study farmers found to be positive towards that trend if this can sustain their peach fruit production; however the footprint of their communication with plant suppliers for alleviating climate change consequences was documented as low. At first place, these behavioral /decision data for peach farm management seems to be conflicting; however, on a deeper look, farmers of this study are waiting climate change strategies and policies to be implemented in order to secure their sustainable path which is quite repetitive phenomenon around the globe (Niles and Mueller 2016).

CONCLUSION

Farmers understand the severity of environmental consequences of climate change; The vast majority of them believe that their previous experience coupled with traditional knowledge will not help them to counteract. Use of internet resources and face to face contact with peach tree propagation sector consists a minor activity in the area of study. Peach farmers are willing more to compromise their lives with the extreme conditions, change crop and find a consensus agreement with the local food industry rather (transformational adaptation) than migrate in other places around the globe with a positive attitude *in situ* towards conventional and novel breeding tools for resilient peach farming.

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