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Tunisia’s Temperate Fruits and Nuts Are Threatened by Climate Change

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Abstract

Fruit and nut orchards make up more than 20 % of Tunisia’s agricultural area. Many species grown in these orchards, such as pistachios, almonds and peaches, fall dormant during the cold season and require low winter temperatures to resume growth in spring. Tunisia is one of the world’s warmest regions where such species are commercially grown. It is therefore likely that these orchards are at high risk from climate change. Tree phenology, the timing of annual life cycle events, has been identified as a sensitive indicator of climate change, and it carries valuable information on the ability of tree species and cultivars to remain viable under changing climate conditions.

To explore past responses to temperature and provide guidance for climate change adaptation, we evaluated long-term bloom records of 37 almond cultivars and 7 pistachio cultivars in Tunisia. Using Partial Least Squares regression, we delineated each cultivar’s chilling and subsequent heat accumulation phases, and estimated chill and heat requirements by adding up all chill and heat accumulated during the respective periods. For both almonds and pistachios, temperatures during the chilling period were the dominant determinant of bloom dates. High temperatures during this period were associated with delayed bloom — a contrast to reports from other regions, which found a dominant bloom-advancing effect of warm springs.

Increasing occurrences of delayed flowering are a concern to Tunisia’s growers, because late bloom has been associated with poor fruit quality and low yields. In some years, low winter chill completely prevented trees from breaking dormancy, leading to complete crop failure. While providing clear evidence that the production of temperate fruits and nuts in Tunisia is threatened by winter warming, this study also highlights shortcomings of existing tree phenology models, which currently restrict farmers’ ability to anticipate chill-related problems and develop adequate adaptation strategies. The challenge of maintaining the productivity of Tunisia’s orchards in a warming climate requires heightened scientific attention to dormancy-breaking processes and their responses to climatic factors.

Keywords: Chilling model, climate change, Fruit and nut trees, Mediterranean region, PLS regression