USDA RESEARCH - Olive Production (Texas)

Project Title: The effect of high temperature interruptions during inductive period on the extent of flowering and on metabolic responses in olives (Olea europaea L.)

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Submitted to: Scientia Horticulturae
Publication Type: Peer Reviewed Journal
Publication Acceptance Date: March 14, 2011
Publication Date: June 1, 2011
Citation: Malik, N.S., Perez, J.L. 2011.

Interpretive Summary: Olives require chilling during winter months for induction of flowering that ends with bud burst in spring. In addition to nighttime chilling requirements, various levels of optimal daytime temperatures have also been described and the negative effects of high daytime temperature on various stages starting from pollination to fruit set have been described. In controlled growth room studies, we have previously shown that a drastic reduction in flowering and fruiting occurred in 'Arbequina' cultivar when daytime temperatures were kept at 25°C for a few hours each day.

High temperatures of inhibitory level do occur as heat waves in milder climates such as Texas, US and Ica, Peru; therefore, it is important to obtain detailed information about the occurrence of heat waves to develop predictive models for site selection as well as cultivar selection in warmer areas to forecast the time of harvest as well as extent of harvest for efficiently allocating resources and developing strategies for marketing and sales Therefore, the purpose of this study was to investigate the effects of interruption of inhibitory levels of high temperature waves during the inductive period on the extent of flowering.

From our results, it appears that even a single high temperature interruption of (i.e., 26±1°C for 8 hrs during day and 16±1°C for 8 hrs during night) for six days during a 75 day inductive period could cause strong inhibition (more than 83%) of inflorescence production, although high temperature interruption of shorter duration (e.g. three days) would not have similar effect.

Extending the duration of high temperature interruption to 12 days could further cause reduction in flowering by reducing the number of flowers per inflorescence. Higher levels of arginine in leaves correlated with higher production of inflorescence resulting from uninterrupted induction period.

Technical Abstract: The effect of the duration of high temperature interruption and the timing of it's occurrence during inductive period on the extent of inhibition of inflorescence production in 'Arbequina' olive trees was investigated. Trees kept under inductive conditions in different growth chambers were subjected to high daytime temperature (26±1°C) interruptions for 3, 6, and 12 days. There was no significant difference in the extent of flowering between trees given an uninterrupted induction period and the trees where inductive period was interrupted with high daytime temperatures for three days.

Inflorescence production was significantly reduced by both 6 and 12-day high temperature interruptions. Number of flowers per inflorescence was significantly reduced only with 12 days high temperature interruption. Since there was no significant difference between the extent of inhibition of inflorescence by 6 and 12 days high temperature interruption, therefore, 6 days high temperature interruption was used in subsequent experiments to study the effect of timing of interruption.

A six-day interruption of high temperature produced significant reduction (more than 83%) in inflorescence production irrespective of the time of interruption (i.e., 40 or 50 days after the start of induction) or number of interruptions (i.e., after every 2 week interval). None of these treatments had any significant effect on the number of flowers per inflorescence high levels of free arginine correlated well with optimal production of inflorescence. High temperature interruptions that reduced inflorescence production also resulted in lower levels of arginine in leaves.