Agri Articles
(e-Magazine for Agricultural Articles)
Volume: 04, Issue: 05 (SEP-OCT, 2024)
Available online at http://www.agriarticles.com
©Agri Articles, ISSN: 2582-9882

Ecophysiological Influence on Pomegranate Physiology

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Ecophysiology is the study of how the environment affects plant physiology, these variables are important to the success of any crop. Eco physiological research is used to study the physiological mechanisms of plant development and growth that interact with abiotic and biotic environmental variables. Fruit cracking, lower production and inferior quality are major problem in pomegranate cultivation caused by increasing temperatures in hot arid climates. Ambe bahar is not advised in arid and semi-arid climates for pomegranate because to lower colour development and fruit quality caused by the environment. Water stress during flowering and fruit development influences fruit cracking, fruit quality and yield in pomegranates. Pruning and bloom thinning are used to change the natural growth habits of the pomegranate plant, reducing unnecessary vegetative development and regulating flowering and fruiting for quality production.

Effect of water stress on vegetative growth: Water stress effects on leaf density were positively correlated with stomatal density and negatively with proline content. This finding indicated that leaf drop in response to water stress was associated with increased proline biosynthesis and stomatal closure and it combined hypotheses that show that a plant's ability to acclimatise to water availability involves changes in physiological, anatomical and morphological characteristics of the pomegranate. Reduced stomatal conductance is known for altering the components of CO_2 conductance diffusion from stomatal cavities to carboxylation sites, which may help to sustain photosynthesis while slowing the growth of specific plant organs (Evans and Loreto 2000). Effects of water stress on stomatal area index (SAI) were shown to be adversely linked with leaf chlorophyll (Cha) content. It is possible that lower chlorophyll (Cha) content in pomegranate leaves reflects a reduction in gas exchange due to decreased stomatal dimensions under water scarcity (Liu *et al*. 2019). The considerable impacts of water stress on stomatal conductance, stomatal density & leaf proline content can be utilized for predicting water stress effect on shoot length & leaf number, which could be used as marker to assess pomegranate cultivars' water deficit resistance.

Effect of temperature on flowering and fruit set: Pomegranate flowers are short peduncled or subsessile and there are typically 3 kinds of flower on the same plant: shermaphrodite, male & intermediate forms. In terms of fruit yield, hermaphrodite flowers play most important function. However, the number of hermaphrodite flowers on a pomegranate tree varies depending on the cultivar, flowering season & environments. This percentage is higher at the start of the main flowering season than it is at the end. In many varieties, 25-60 % hermaphrodite flowers, 20- 47 % male flowers and 14- 24 % intermediate forms were observed. Fruit retention increased from about 30 % during early flowering to over 80 % during full bloom and/or late flowering (Hussein *et al*. 1994). The flowers produced 4-5 weeks after the onset of blooming gave the highest fruit set (90 %) with the best fruit quality.

Effect of climatic parameters on quality of fruit

Sunburn: Sunburn is a physiological disease caused by high temperatures, light and radiation, which reduces yield and quality (Schrader *et al*., 2002). Many fruits that are directly exposed to high levels of sunshine burn and change colour, reducing their attraction and causing significant economic losses (Finkel and Holbrook 2000). The surface colours of sunburnt fruits change from brown to black. Furthermore, pomegranate grains lose water and dry out. Sunburn, which is the leading cause of crop loss, can range from 40 to 50 percent.

Fruit Cracking: Cracking of pomegranate fruit is a common problem in all growing locales and types, but the severity is greater in arid regions. Mrig bahar is preferred in dry areas, although fruits are badly damaged by cracking between December-January due to diurnal temperature change. The amount of cracking in pomegranate fruits is directly proportional to the relative water content and water potential of the leaf, which are indicators of water stress. Furthermore, both of these physiological parameters are expected to be affected by high temperature stress, as evaluated by canopy air temperature difference (CATD) and fruit air temperature difference (FATD). The canopy temperature was lower than the air temperature, but the fruit surface temperature was higher. CATD and FATD had a strong correlation with leaf water potential and relative water content. The cultivar with the highest leaf water potential and relative water content (RWC) had the lowest fruit cracking and vice versa (Singh *et al*., 2014).

Ring Colour Development: Manera *et al*. found that the measured colorimetric parameters of pomegranate rind were strongly associated with air temperature during fruit development and ripening. All correlation values were higher than 0.9, indicating a considerable effect of air temperature to rind colour development in pomegranates. Pomegranate rind revealed greener tones at the beginning of fruit development. The Chroma index and the hue angle together showed exactly when pomegranate rind colour turned from green to red. The turning point rind colour from green to red during the second week of September, when temperature records started dropping, coinciding with the onset of pomegranate rind colour change.

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