

Phenology of mango (*Mangifera indica* L.) under varied crop age and management strategies for higher productivity in semi-arid tropics of Indian sub-continent

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India owes lion share in the mango (*Mangifera indica* L.) production, contributing ~40% of world's total production. Despite the expansion in cultivated area, yield levels are stagnant, rather diminishing over the recent years in the Indian sub-continent. This paradox is largely ascribed to aging orchards coupled with unscientific management. To address this issue, a field experiment was conducted for two consecutive years (2020–2021 and 2021–2022) to assess the influence of tree age and management drives on two major phenological stages (flowering and fruiting) of mango. Two fruit production cycles (i.e., from vegetative bud initiation to fruit maturity) were studied in a regional dominant mango hybrid (Mallika) belonging to two age groups (20 and 28 years old). Pooled analysis revealed that a significantly higher number of panicles (325), hermaphrodite flowers (285), and the least flower drop (96.3%) in 20-year-old trees managed with plant protection chemicals (PPCs). Consequently, significantly higher fruit yield (74.34 kg tree⁻¹), fruit volume (440.3 cm³) and total sugar content (20.03%) were also observed in younger trees managed with PPCs. Further, the final yield levels were a mere reflection of the number of panicles, hermaphrodite flowers, and fruits retained per panicle at different stages, as a strong and positive correlation existed among them.

Keywords: Fruit quality, fruit yield, phenophases, plant protection chemicals, tree age

tropical fruits, having greater consumer preference, so it is commonly designated as the king of fruits¹. In India, mango is cultivated over an area of 2.3 m ha, accounting for an annual production of 2.1 m metric tons (@ 8.8 Mt/ha)². Among many states cultivating mango in India, Karnataka is the major one contributing to 16.4 million tons per annum with a coverage of 1.7 lakh ha (@ 9.5 Mt/ha). In Karnataka, mango is largely cultivated under rainfed conditions. Surprisingly, there has been a visible increase in area, production, and productivity of the crop from 1992 to 2012, yet a declining trend in crop productivity has been noticed from 2012. Though there has been a substantial increase in area under mango over the years, decrements in crop productivity have been observed, attributed to the age of the trees, i.e., predominance of either older or younger trees in the major number of orchards, trees being either overaged or underaged to produce an economic yield. It is evident that there has been a drastic reduction in the production and productivity (negative deviation from the moving average) of the crop from 2011–2012, despite increased area under cultivation (positive deviation from the moving average). Clearly indicating the impact of tree age on the productivity of the crop in the state.

Looking into the optimal growing conditions, mango grows well at an altitude of 1400 m above mean sea level, temperatures ranging between 18°C–35°C, and can tolerate higher temperatures up to 48°C under irrigated conditions. The studies by Roemer *et al.*³ on the influence of weather parameters on mango flowering behaviour showed similar results. They inferred that maximum air temperature >30°C, mean relative humidity between 60–70%, and fruit