Development of allometric equations for grafted sapota (*Manilkara zapota*) through destructive tree sampling for non-destructive estimation of tree biomass

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Sapota fruit tree biomass cannot be estimated using general forest tree allometric equations involving measurement of diameter at breast height (DBH) as grafted sapota tree branches below this height. Therefore grafted sapota trees of commercial orchards require an independent allometric equation for nondestructive estimation of tree biomass. Sapota allometric equations were hence developed with a destructive sampling of grafted sapota trees using parameters other than DBH and compared with other equations developed for grafted mangoes. The selected allometric parameters were significantly related to the age of the trees. The root-to-shoot ratio also differed from those reported for forest trees. The biomass expansion factor by and large attained stability beyond 16 years of tree age. The equations so developed generally fitted the data well, and in most cases, more than 50% of the observed variation in biomass was explained by primary branch girth × number of primary branches. There was a good agreement between the observed and the predicted biomass using both multiple linear regression and power model equations. Further, our purpose was to see if the grafted mango tree equation can predict sapota tree biomass. The results of this study confirmed that the mango equation equally predicts sapota tree biomass and hence the mango tree allometric equation can also be used for estimating sapota tree biomass efficiently.

Keywords: Allometric equation, biomass expansion factor, grafted trees, mango, sapota.

world. The use of such models saves both living trees and time with a degree of compromise on the accuracy.

The carbon-dense nature of tropical fruit trees is high carbon sequesters. The large conversion of agricultural land into fruit orchards is a win–win situation to grab the opportunity to sequester carbon on a large scale. In the estimation of tree biomass, destructive methods are the most accurate methods. However, while using destructive methods, both live trees and time have to be sacrificed. Alternatively, allometric biomass models are simple mathematical models to non-destructively estimate tree biomass by using independent variables such as diameter at breast height (DBH), wood density, tree volume, etc.[2]. In this article, we report biomass distribution patterns and the development of sapota-specific allometric equations and also attempt extrapolation of mango allometric equation to sapota for estimation of CS in sapota orchards of India.

Materials and method

The present study was carried out between 2020 and 2023 at the Indian Institute of Horticultural Research, Bengaluru. The allometric equation developed for grafted mango was the basis for this study as it utilized a basic tree parameter common to all grafted fruit trees[1]. We used the same methodology to develop sapota-specific allometric equation by destructive sampling and using the estimated tree biomass for developing the equation. Fruit-bearing