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Regulation of Acid Lime Cultivation: Flowering, Yield and Quality by Utilization of Gibberellic Acid

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Abstract

Acid lime is one among the important fruit crop in the citrus groups and is botanically known as *Citrus aurantifolia.* Owing to its economic and nutritional significance it is regarded as one of the high value fruit crops. The crop faces constraints such as irregular flowering, poor yield and inadequate fruit quality. These hurdles could be overcome by the use of foliar application of plant growth regulators ensuring higher profitability, sustainability and superior fruit quality. Gibberellic acid (GA), a tetracyclic di-terpenoid molecule, is a plant hormone that promotes plant growth and development. Plant growth, flower development, sex expression, fruit development and fruit quality are impacted by gibberellic acid migration. Therefore, it is necessary for the successful production of crops.

Keywords: Acid lime, Gibberellic acid, Growth regulator, Yield and quality

Introduction

Citrus has global importance among fruits and it has wider adaptability in tropical and subtropical areas. It is the third most popular subtropical fruit worldwide due to it palatability and nutritional value. Among citrus species, acid lime (*Citrus aurantifolia* Swingle) is the third most important species next to mandarins and sweet oranges. Acid lime belongs to Rutaceae family and its chromosome no. is 18 (diploid). In India, acid lime accounts for ten per cent of area occupied by citrus group of fruits. India produces the most acid lime in the world, with 37.87 lakh metric tons from an area of 3.12 lakh hectares (Ahmad *et al.*, 2024). Fruits from acid limes have beneficial medicinal value. Acid lime fruits, which are naturally acidic and it is an incredible appetizer, antihelmentic, anti fungal, anti inflammation, antioxidant properties and helps with stomach ache and biliousness. Despite nutritional importance, acid lime production is facing problems in various aspects such as irregular flowering, poor yield and inadequate fruit quality. Therefore to ensure higher profitability, sustainability and superior fruit quality, foliar application of plant growth regulators can be used. Also to induce blooming, plant growth regulators can be incorporated (Figure 1).

Foliar feeding of plants is one of the most significant methods of delivering nutrients directly to the metabolic site and nutrients are not lost as occurs with soil application. Among various PGR's, gibberellic acid proved to be the most effective growth regulator to prolong the blooming duration and enhance both the yield and quality of fruits during the hasta bahar season.

Figure 1: Flowering and fruiting stage of acid lime tree

Bahar Treatment

Acid lime typically flowers three times a year *i.e.*, in Hasta bahar (September-October), Mrig bahar (June-July) and Ambe bahar (January-February). Ambe, Mrig and Hasta

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bahar bloom at rates of 47%, 36% and 17%, respectively. Monsoon rains that preceding the initiation of flowers results in low flowering and fruiting in Hasta bahar (17%) only. Hasta bahar fruits become available in April and May when there is high demand in market and are sold at a premium price compared to the profits received during other seasons.

Plant Growth Regulators and Its Application

Gibberellins (GAs), which contain tetracyclic and diterpenoid chemical compounds, are endogenous plant growth hormones. GA_3 influences flower initiation and promotes fertilization. Promoting the activation of hydrolytic enzymes, generating flower structures, starting blooming and growing flower organs are just a few of the various roles that GA_3 performs in plant development processes which stimulates cell division and cell elongation. Treatment of GA_3 resulted to the continuous production of glucose-6-phosphate through fruit growth, which is thought to be a precursor of vitamin C (Figure 2).

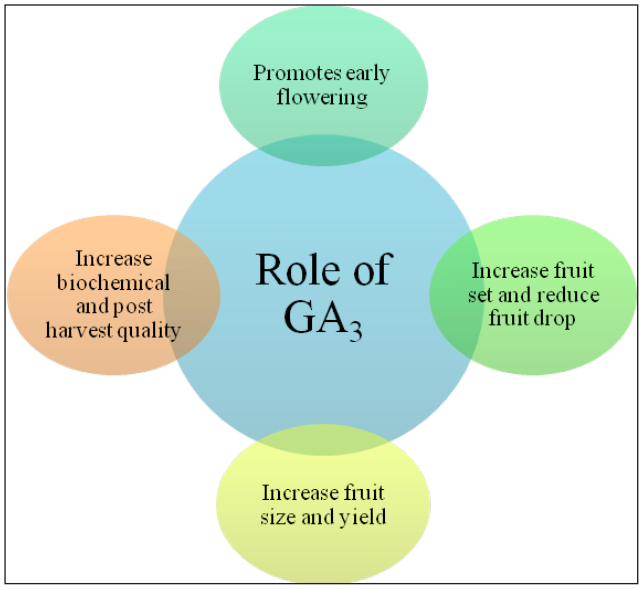

Figure 2: Role of Gibberellic acid in acid lime

✓ According to Bairwa *et al*. (2025), GA_3 at 100 mg L^{-1} significantly improved Kagzi acid lime production metrics, such as blooming, fruit set and yield.

✓ Samaradiwakara *et al*. (2023) concluded that the preharvest foliar treatment of 37.5 mg L^{-1} GA_3 extended the fruit's maturity.

✓ As reported by Jagtap *et al*. (2013), GA_3 50 mg L^{-1} significantly increased yield-attributable characteristics such as fruit volume, fruit diameter, fruit mass and fruit yield per individual tree and significantly increased quality-attributable characteristics such as sugar content and ascorbic acid content of the fruit, while the average number of seeds in each fruit and acidity were decreased.

Conclusion

Application of endogenous or intrinsic PGR plays a vital role in various processes of plant growth and maturation. Morpho-physiological characters such as blossoming, fruiting ability and yield as well as quality parameters such as weight, length, firmness, colour, vitamin C or ascorbic acid, total soluble solids and total sugar content can be augmented or boosted by the application of Gibberellic acid. These PGR bio-manipulations in fruits also contribute for the persistent production in large scale and also curtail post harvest deterioration. Furthermore, PGR application helps in stress tolerance against various non-living or abiotic factors such as drought, salt, high as well as low temperature *etc*. Therefore, one of the sustainable tools for climate resilient production of fruit crops is application of gibberellic acid as it enhances over all yield, quality and stress tolerance.

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