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The Impact of Micronutrients on Fruit Production of Guava

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Guava (*Psidium guajava* L.) is one of the important fruit crops of tropical and sub-tropical region of India. It is commonly known as 'Apple of Tropics' or 'Fruit of masses' owing to its high nutritive value. It belongs to the family Myrtaceae. It has a basic chromosome number of x=11. Even though guava is originated to tropical America (Peru), it is now cultivated and naturalized throughout the tropics and due to increasing demand. It is one of the important fruit crops of country. It is highly nutritious in nature, having several medicinal properties, consumed both as fresh fruit and post processed in different value-added products and considered as multiuse tree due to its usefulness as a fruit, fuel, fodder, timber and it is highly profitable crop.

It is considered as one of the ideal fruits from nutritional point of view. Its composition varies with cultivars, stage of maturity and season. It contains good amount of antioxidant that helps in controlling systolic blood pressure. Its peel and seeds have anti-cancer, anti-inflammatory, and systemic effects on digestion, improve diabetes and skin problems. It is good source of pectin, which is an important constituent of the jelly and other quality products. Per 100 g of fruit contains fair amount of Vitamin C(75-260 mg/100 g), Thiamine (0.03-0.07 mg/100 g), Riboflavin (0.02-0.04 mg/100 g), Potassium (417 mg), Phosphorus (22.5-40 mg/100 g), Zinc (0.23 mg), Calcium (10-30 mg/100 g), Iron (20-25 mg/100 g) and Pectin (0.5-1.8%).

Soil and climatic requirement:

It is grown in almost all types of soils, however, the acidic soils preferably with good drainage are preferred. It can tolerate soil pH up to 4.5-9.4. It is grown successfully upto an altitude of 1,500 m above mean sea level with ideal temperature range between 20°C and 30°C. It can withstand extreme temperature as well as drought in the summer season of North India but it is unable to tolerate acute frost. The needed annual rainfall is between 1000 and 2000 mm, although it is drought tolerant crop.

Guava bears three crops in a year. There are three distinct flowering seasons i.e. summer, rainy, and autumn with corresponding harvesting periods rainy, winter and spring seasons. It is generally observed that guava trees produce heavy crop in rainy season, light crop in winter and very light crop in spring season. Fruits of winter season crop are superior in quality than rainy season fruits, as they are free from insect-pests and diseases with better storage life and fetch two to three times more price in the market during winter season.

Current status of guava in India

Presently, India is the world's top guava-producing country, with a growing area of 3.14 lakh ha and 4.92 million tons of production. India is the largest producer of guava in the world, producing 45.82 105 metric tons of fruits (Anonymous, 2023). The fruit is in great demand in domestic as well as in international markets and traded in more than 60 countries.

Fig 1: Flowering, foliar application of micronutrients in guava and mature stage of fruit

Purpose of micronutrients

Micronutrients such as zinc (Zn), boron (B), copper (Cu) and iron (Fe) play a crucial role in the growth, development, fruit retention and quality of fruit. Guava responds well to applied micronutrients, for improving growth, yield and fruit quality. They can be applied in soil as well as foliar application. Use of different single and mixed micronutrients like, zinc sulphate, ferrous sulphate, and boron applied through foliar means was found more advantageous compared to soil application. They have intense effect on fruit quality through its influence on size, appearance, colour, soluble solids, sugar, acidity, pectin and vitamin contents. By analyzing the effect of specific micronutrients on fruit quality we aim to provide valuable insights for farmers and researchers in optimizing guava production. We hope to empower farmers and stakeholders to make informed decisions that will ultimately lead to a more sustainable and

profitable industry. Here's how these micronutrients affect the quality fruit production of guava.

Iron

Iron is necessary for many enzyme functions and function as a catalyst for the synthesis of chlorophyll. It is essential for the young growing parts of plants. Some of its deficiency symptoms are pale leaf color of young leaves followed by yellowing of leaves and large veins. It is lost by leaching. Under conditions of high pH (alkaline) it is rendered unavailable to plants.

Boron

Boron is a heavy non-metal micronutrient that is essential for improving pollen viability, pollen tube growth, reproduction of plants, active salt absorption and fertilization, thus it produces a healthy fruit set. It also prevents fruit drop. It enhances nitrogen uptake and thus helps, the process of photosynthesis, which ultimately leads to the accumulation of carbohydrates and helps in increasing and translocation of the sugar content of the fruits. It is necessary for cell wall formation, membrane integrity, calcium uptake, water relationships and the movement of hormones. Its deficiency kills terminal bud leaving a rosette effect on the plant, leaves are thick, curled and brittle whereas fruits, tubers and roots are discolored, cracked and flecked with brown spots.

Zinc

Zinc is involved in many enzymatic reactions for growth and development of plant. It is also involved in regulating the protein and carbohydrates metabolism (Shreekant *et al*., 2017). It is a component of enzymes or a functional cofactor of a large number of enzymes including auxins. Some of its major functions include carbohydrate metabolism, protein synthesis and internodal elongation. Deficient plants have mottled leaves with irregular chlorotic areas. Its deficiency cause bronzing in guava and leads to iron deficiency. It had an additive effect on yield because it is actively involved in enzyme regulation, plant metabolism, and maintaining the ideal balance of nutrients and growth substances in cells.

Benefits of micronutrients

- Improves growth, yield and quality.
- Help in plant uptake of major nutrients and play active roles in the plant metabolism like cell wall development, photosynthesis, chlorophyll formation, enzyme activity, nitrogen fixation and oxidation-reduction reaction.
- Horticultural crops generally respond better to the foliar application of micronutrients than soil application. They are required by plants in comparatively lesser amount and thus, can be applied more safely through foliar spraying which offers the possibility of quick absorption in plant cells at time of maximum requirements by the plants.
- Enhanced fruit set percentage and reduced the fruit drop percentage,
- Influence early maturity of fruit, fruit set as well as fruit retention percentage
- Involved in enzyme regulation and plant metabolism

Status of use of micronutrients in India

In 2000 Das *et al.* and Alloway in 2004 has reported that zinc sulfate (0.5 or 1.0%) had enhanced the biochemical properties of the fruit along with the some of the quality parameter and yield of guava fruit. Similar findings were also observed by Rajkumar *et al.* (2014) in Bikaner, Rajasthan where their research studies showed positive effect of foliar application of zinc and boron on fruit yield and quality of winter season guava, cv. Pant Prabhat. These studies were further supported by Ribeiroa *et al*. 2020, Shreekant *et al.* (2017) and Baranwal *et al.* (2017) in guava, with treatment of zinc sulphate (1.0%) + boron (1.0%) maximum fruit width and highest fruit weight were obtained. The rise in average weight of fruit were in accordance with the findings of Bhatt *et al.* (2012) in mango, Tanuja *et al.* (2016) in pomegranate in Srinagar (Garhwal), Uttarakhand and Sachin *et al*. (2019) in Meerut in guava.

In Faizabad (U.P.) Shreekant *et al*. (2017) also investigated the significant effect of foliar application of Zinc sulphate (0.5%, 1.0%), Borax (0.5%, 1.0%) and Copper sulphate (0.5%, 1.0%) on fruit set, quality and yield of winter season guava cv. L-49. Under Lucknow conditions Meena *et al*. (2023) also investigated the positive effect of zinc and boron on growth, yield and quality of guava (*Psidium guajava* L.) cv. L-49 and found that they were significantly affected by foliar application of Borax 0.2% + Zinc Sulphate 0.2%. In Haryana similar results were also found by Baloda *et al*. (2024) during his experiment to assess the effect of foliar application of nutrients on the yield and quality aspects of rainy season guava (*Psidium guajava* L.).

Time of application of micronutrients

For better growth and development of all fruit crops nutrition is required and need of nutrients vary from crop to crop and edaphic factors. Time of

fertilizer application depends on the crop taken and the region. Generally, under North Indian conditions application of micronutrients should be done with the onset of monsoon July-August for winter season crop.

Conclusion

For successful production of guava adequate supply of nutrients with optimum dose of fertilizer, at appropriate time and at appropriate depth is essential. Either only soil application or foliar application or both combined application of micronutrients influences the vegetative, reproductive and quality parameters of guava fruit. Different quality attributes like TSS, ascorbic acid content of fruit, total sugar, reducing sugar and non- reducing sugar content, TSS/acid ratio and fruit set, number of fruits tree^{-1} and fruit yield (kg tree^{-1} and t ha^{-1}) were enhanced with reduced fruit drop and acidity. Therefore, it may be concluded that the application of micronutrients along with a recommended dose of NPK may be acclaimed for improving plant growth, yield, and fruit quality of guava. The incorporation of advances in agricultural research and technology allows for more precise nutrient management recommendations in guava cultivation.

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