

Introduction

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The competitive global fruit market necessitates production of high-quality fruit for the success of any fruit grower regardless of where the fruit is grown. Fruit tree nutrition plays an important role in fruit quality and storage life. The nutritional status of a fruit tree is influenced by many genetic and environmental factors. Among these factors are soil chemistry and physics, scion and rootstock genetic characteristics and adaptability, and weather conditions. Consequently, pomologists throughout the world are focusing on selection of appropriate rootstocks and application of precise amounts of nutrients to produce high quality fruit under different environmental conditions.

Nutrient management is one of the biggest challenges in modern fruit production. Many growers have often been using excess amounts of some nutrients such as nitrogen in fruit crops, assuming that higher application would lead to higher production. However, application of precise amounts of required nutrients to tree fruit is becoming extremely important in the recent years because researchers are finding that excess nutrients would lead to adverse fruit quality. At the same time, the increasing public awareness to health issues and environmental concerns necessitates precise use of nutrients, particularly nitrate. Among the nutrients that are essential and can influence fruit quality and storage life, nitrogen, calcium, and potassium are extremely important. Nitrogen is the most important element for growth of most plants including fruit trees. Low nitrogen would lead to poor growth and low productivity; however, excess nitrogen can reduce fruit color and firmness and increase evolved ethylene and respiration in apples (*Malus domestica*) and ultimately lead to postharvest internal breakdown. Calcium is also essential for tree fruit as low calcium in the fruit tissue could lead to firmness loss, storage disorders such as bitter pit, and postharvest diseases. Potassium is also an essential element in tree fruit. Since there is a high total consumption of potassium by the fruit during heavy cropping years in apples, potassium deficiency may develop after a few years of heavy cropping and the problem of potassium depletion could be more severe in the soils with low potassium. On the other hand, excess potassium may adversely affect fruit quality. Ratios between some elements such as nitrogen, phosphorus, potassium, calcium, and magnesium either in the soil or in any of the above-ground tissues of fruit trees, including fruit tissue, can be as important or even more important than the absolute amounts of these elements for fruit quality.

In many cases, the soil could contain adequate amount of a certain element, but the element is not available to the tree. Calcium would perfectly fit in this category. Microelements are also extremely important in the growth and development of tree fruit. Iron, zinc, copper, and boron deficiencies can seriously reduce tree growth and fruit quality. Boron is important to the tree growth and fruit biochemical processes. However, high levels of boron can reduce fruit firmness and enhance maturity and internal breakdown of apples.

High pH in many fruit growing areas of the world can lead to deficiency of most of essential microelements and adversely affect fruit quality. However, low soil pH in some fruit growing areas can result in plant toxicity due to excessive uptake of micronutrients such as aluminum and iron.

There is an increasing trend toward establishing high-density orchards worldwide. The use of dwarfing rootstocks is essential for establishment of high-density orchards. Rootstocks can greatly influence mineral uptake and fruit quality. However, because of the nature of biennial bearing and effects of cropping, separating effects of rootstock from crop load effects is difficult and requires long-term studies.

In this symposium, some of the world's leading researchers in the field of fruit nutrition have discussed several important issues of the fruit nutrition. Although in many cases particular nutritional issues of a country such as Canada, Italy, Belgium, and the United States are discussed, many of these issues can have broader applications to other similar areas in the world.