

## **NUTRIENT MANAGEMENT IN FRUIT CROPS FUTURE RESEARCH STRATEGIES**

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The market demand for fruits has increased in the recent past due to increased income, urbanization, export demand, health and nutritional awareness. Export of pineapple, banana, mango, mangosteen, rambutan and papaya also has increased considerably in the recent past. The export potential of these fruits is very high and therefore, special attention is needed to ensure continuous supply of quality fruits. Efficient management of resources, use of improved seed and planting materials and introduction of improved irrigation techniques will bring about increased yields and thereby enhanced earnings to the growers.

Efficient nutrient management is essential for obtaining optimum productivity of any crop. Unfortunately, nutrient management can be considered as one of the most neglected aspects for majority of fruit crops in the past. Therefore, fruit crop yields are not at optimal levels and also not consistent. The quality of fruits is not up to export standards. Even the improved varieties provide low quality fruits due to neglected nutrient management practices currently adopted by local producers.

On the other hand, current nutrient management techniques for majority of fruit crops are based on foreign research information. Hence, to increase the national fruit production, in addition to other factors, due attention should be given to nutrient management practices of fruit crops, locally.

Except few commercial growers, most small scale farmers rarely use any fertilizers or organic manure for most fruit crops. Even for market oriented fruit crops, fertilizer usage is not systematic due to insufficient knowledge in nutrient management. Therefore, there is an urgent need to develop fertilizer recommendations for important fruit crops for different agro climatic regions. Information generated by local research is vital for this purpose.

## MAJOR NUTRIENTS

At the beginning, it is necessary to study requirements of nutrients such as N, P and K for important fruit crops grown under different soil and environmental conditions in Sri Lanka.

This study should then be expanded to find out the most suitable fertilizer sources, which have high nutrient supply efficiencies for long periods as fruit trees have longer life periods. On the other hand, the ability to use locally available fertilizer sources like Eppawela rock phosphate as a phosphorous source for fruit crops even in acid soils also must be included in these studies to reduce fertilizer cost.

As time of application of fertilizers for fruit trees plays a major role for ultimate fruit yield and quality, research must focus on the most suitable time of application of different fertilizer materials for different fruit crops. Rainfall pattern of major fruit growing areas of Sri Lanka should be considered in these studies as most fruits are grown under rainfed conditions.

Foliar spray of different soluble N, P and K fertilizers at critical growth stages of fruit crops have shown tremendous response in yield and quality (Kulasingham, 1983). Therefore, research must focus on suitable fertilizer materials, which could be used as foliar fertilizers in addition to those fed through the soil system. The research must determine effective concentrations and the most suitable time of application of nutrient solutions. Based on these research results, we will be able to introduce suitable fertilizer recommendations and nutrient management packages for major nutrients to suit local conditions.

## SECONDARY NUTRIENTS

Studies should concentrate on secondary nutrients such as Ca, Mg and S and their effects on yield and fruit quality. Soil sample testing results indicate that wet zone areas are deficient in Ca and Mg. These deficiencies can be a cause for low yields, low keeping quality and irregular ripening of major fruits such as Rambutan and Banana grown in this area. Therefore, research programmes should be initiated in this direction too. The research should

reveal information that can be used to formulate recommendations with regard to amount, time, method and frequency of specific fertilizer applications to supply secondary nutrients.

## MICRONUTRIENTS

Micronutrients also play a major rôle in yield and quality of fruits (Chattopadhyay and Gogoi, 1990). Especially, flower initiation, fruit setting and fruit remaining (Ghanta and Dwivedi, 1993), external appearance, inner quality, keeping quality, vitamin, sugar and acid contents in fruits (Kumar and Kumar, 1989) are governed by micronutrients. With high export potential for quality fruits, ways and means of using micronutrients must be studied to increase the quality of fruits to meet future demand.

## ORGANIC MANURE

Fruit crops show tremendous response to added organic manure (Herath and Pinto, 1977). Therefore, it is more important to study an integrated plant nutrient management system including freely available animal wastes, crop residues, live and dead mulches together with different levels of inorganic fertilizers to increase the crop yields.

One problem encountered is the slow decay of organic manures with high C:N ratio. Application of organic manures with high C:N ratio such as coir dust, sow dust, rice husk mixed with low C:N materials to planting holes and allow to decompose slowly leads to slow but steady nutrient supply to growing fruit crops (Jayasundara, 1995- unpublished). With the adoption of this technique, only surface application of nutrients is required in order to maintain the sustainable fertility status of the soil for perennial fruit crops.

## LIMING

Most fruit crops are perennial or semi - perennials and they require, continuous supply of plant nutrients throughout their life period. Therefore, maintenance of soil pH at optimum level throughout the life periods of fruit plants is important to ensure the availability of plant nutrients. Continuous

liming of fruit growing soils will help maintain soil pH. Since fruits are grown in soil with varying pH conditions, research must focus to find out suitable liming materials available locally. Research can take into consideration plant nutrients available in liming materials in addition to Ca. Amount and application intervals for major fruit crops should also be studied.

#### MAINTENANCE OF CRITICAL NUTRIENT LEVELS IN PLANT TISSUES

Most fruit crops are sensitive to critical nutrient status in plant tissues for flowering, fruit setting and fruit dropping (Bhargava and Reddy, 1992). Therefore, it is very important to maintain correct nutrient concentrations in such tissues at these stages. This cannot be easily achieved by soil application of fertilizer since the uptake of nutrients depends on other environmental factors as well. Therefore, foliar application of nutrient solutions may be more effective.

Future research activities must focus in this direction in addition to conventional nutrient management through the soil system. For this purpose, research must find out appropriate nutrient solutions and suitable concentrations of these solutions, which could be applied at different growing stages of the fruit trees and their time of application.

#### CHEMICAL COMPOUNDS AND HORMONES

Off-season production of fruits is more profitable due to high demand and also it provides continuous supply of fruits. It has been observed that flower initiation through breaking bud dormancy using chemicals like KNO<sub>3</sub> and paclobutrazole during off – seasons is very effective (Mass, 1989). It is another aspect to be investigated in future. Hormones like gibberelic acid (GA) and indole acetic acid (IAA) are available to induce flowering and also to reduce the height of plants without affecting the yields. This is especially important in taller trees where harvesting is difficult and also taller trees are prone to wind damage.

## IRRIGATION TECHNIQUES AND FERTILIZERS

Dry zone of Sri Lanka possess high potential for fruit production in Sri Lanka, where soil and climatic conditions are ideal for fruit crops (Jochim, 1936). However, water stress during dry periods is the main limiting factor in dry zone. Therefore, research activities must focus on different irrigation techniques combined with method and amount of fertilizer materials to maximize water and fertilizer efficiencies.

Fertilizer application with irrigation water through drip irrigation technique (Fertigation) was more effective and economical for fruit crops since nutrient losses and labour cost are minimized (Fujiyama and Nagai, 1989). However, local research information in this aspect is limited. Therefore, research can work on the type of micro irrigation combined with fertigation emphasising on, time of fertilizer application, concentrations of different fertilizer solutions and frequency of application to maximize fruit yields.

## NUTRIENT MANAGEMENT IN NURSERIES

Most research activities in fruit cultivation mainly focus on plants under orchard conditions and little work has been done on nutrient supply for nursery plants. Since correct nutrient management in nurseries leads to healthy and vigorous plants, which produce higher yields, this aspect also should be given high priority.

New technologies such as rapid multiplication and *in-vitro* propagation of planting materials are being used to increase production. Researchers have to find ways of hardening and feeding them with balanced nutrients to raise healthy vigorous plants.

## CONCLUSION

The need of the day is to produce high quality fruits in large amounts to meet both local and export demands and to increase income from fruit cultivation. New local research information on the above discussed aspects of nutrient management will help to provide a package of practices in nutrient management to local farmers to increase production. This package of information

should contain recommendations with regard to amount, time, method and frequency of specific fertilizer applications to supply major, secondary and micronutrients to suit local conditions. In addition, research as discussed above will help to increase the use of locally available inorganic and organic fertilizer materials to enhance production.

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