

Improvements of Postharvest Quality of Tomato (*Lycopersicon esculentum* Mill.) through Preharvest Macro and Micro Nutrient supplementations

K.M.S. Weerasinghe^{1*}, A.H.K. Balasooriya¹, S.L. Ransinghe¹, I. U. De Silva,

R.S. Brahakmanage and L.C. Wijethilka²

¹Department of Agriculture and Plantation Engineering, Open University of Sri Lanka, ²Regional Agriculture Research Centre, Makadura

kalindu_weerasinghe@yahoo.com

Abstract

Highly perishable nature of Tomato (*Lycopersicon esculentum* Mill) encounters several problems in marketing. A field experiment was carried out to investigate the potentiality of enhancing customer preferred postharvest qualities of tomato such as higher brix value, higher pericarp thickness, good keeping quality and general appearance through preharvest macro and micronutrient supplementations. The study revealed that, preharvest essential macro and micronutrient supplementations can significantly improve the pericarp thickness, general appearance, brix value and keeping quality.

Introduction

Tomato (*Lycopersicon esculentum* Mill.) belonging to the family *Solanaceae*. According to the customs reports, in 2003 the Sri Lanka had imported 1.24 tons and annually about 488 tons processed products of tomato worth 52 million rupees; due to the increase in its medicinal value and multiusability there is a trend to increase the tomato consumption by consumers. The consumer demand is for moderate size, red colored tomato with good appearance and good taste. In order to increase the marketable yield and the income of the tomato farmers, it is essential to improve yield quality related characteristics according to customer preferences such as higher brix value, higher pericarp thickness

and most importantly increase the keeping quality. In Sri Lanka, a postharvest loss of fresh tomato is estimated to be about 54% which is eventually contributes to high market prices and consumers show higher reluctance to buy lower quality tomatoes. Postharvest losses may likely emerge from inability of the fruits to maintain certain postharvest qualities such as good keeping quality, fresh appearance among others. Among the other postharvest quality improvement techniques, effects of preharvest factors on postharvest quality are often overlooked and underestimated. It is critical to understand that tomato fruit quality is only maintained postharvest it is not improved during the harvest and storage processes. Thus, it is of utmost important to consider the preharvest factors that allow maximizing the quality of the tomato going into storage. Preharvest application of essential nutrients claimed to be effective factor influencing quality of tomato before and after harvest. The commonly used general fertilizer recommendations for vegetable crops in Sri Lanka are often limited to the supply of N, P and K and do not include secondary and micronutrients (Kirthisinghe *et al.*, 2007). According to Weerasinghe *et.al*, (2012) it is a well-known fact that micronutrients are mainly involved in plant enzymatic process and required to obtain high quality yields. Many authors report on micronutrient deficiencies in soil and beneficial effects

of micronutrients when its supply to various cultivated plants is enhanced (Weerasinghe et.al, 2012). Therefore as a remedy for some of the problems proper fertilization practices can be introduced. The present study was aimed at investigating the effects of different soil macro and micronutrient fertilizer combinations on TSS, general appearance and keeping quality of *Thilina* one of the most popular DOA recommended commercial tomato cultivar.

Materials & Methods

This experiment was conducted at Regional Agricultural Research Center *Makadura*. Selected experimental design is Randomized Complete Block Design (RCBD). There were six treatments in this experiment and each treatment was replicated three times. Other than the DOA recommendation and there were five treatment combinations of Ontario recommended dosage of nutrients for tomato (Blom, et.al. 1989). The mean data was subjected to the statistical analysis using SAS package and mean separation (Duncan's Multiple Range test at 5% probability level) procedure.

Result and Discussion

A simple brix/TSS measurement shows all of the dissolved solids not only the sugar content in the sample which include soluble chemicals, minerals, carbohydrates, amino acids etc. TSS was measured by extracting juice from 30 % ripen tomato fruits on ATAGO hand held Refractrometer. According to the results in Table 1, T4, T5 and T6 significantly affects the TSS positively they are not significantly differ from each other. The higher mean value of TSS recorded from fruits harvest from T4 (5.4) over fruits from other treatments due

to favorable effect of highest concentration of micronutrient supplementations with macro nutrients. T1 showed significantly lower value (5.1) in terms of brix. In general micro nutrients containing treatments showed positive results in terms brix than T1. Higher brix values means, the better quality and the more nutritionally dense and flavor, sweetness of the produce. Total soluble solids are known to increase fruit quality (Loboda and Chuprikova, 1999), which fits well with consumers demand for high quality produce (El-Saeid et al., 1996). Since consumers prefers sweet tomato with high brix value to those with low brix value tomatoes. Supplementation of micronutrient can increase market demand. General appearance of fruits plays an important role in making purchasing decisions and is affected mainly by fruits firmness, weight loss and fruit colour incidences. Fruit general appearance was scored by overall rating that included freshness (green calyx), decay, firmness, defects, colour on a scale of 1-5 with: 0-1= Poor, 2-3= Good and 4-5= Very good. Since weight (water) loss is the principal cause of fruit softening and shriveling (Wilson et al., 1999) general appearance of fruit may change with weight loss there by market demand reduce with loss of weight. Results showed T2, T3, T4, T5 and T6 significantly superior to the T1 in terms of general appearance. This may be due to relatively high and readily available macro secondary and micro nutrients might have increased fruit firmness and also increased biosynthesis in carotenoids which are responsible for tomato fruit colour. Literature largely suggest that increase of pericarp thickness affect positively to appearance, fruit firmness and reduce water loss Nyamah et.al (2011), Results showed

Ontario amended pots T2, T3, T4, T5 and T6 which is rich with essential macro and micronutrients are significantly better to the T1 in terms of pericarp thickness. The keeping quality was determined from the starts of harvesting and extended up to the start of rotting of fruits (Mondal, 2000). Results showed that T2, T4, T5 and T6 significantly better to T1 which is amended with DOA recommendation.

Treatment	Pericarp Thickness (mm)	Brix Value	Keeping Quality/ shelf-Life (days)	General Appearance (GA)
T1	5.6 ^b	5.1 ^d	7 ^b	3.12 ^b
T2	6 ^a	5.3 ^{bc}	11 ^a	3.6 ^a
T3	6 ^a	5.2 ^c	11 ^a	3.53 ^a
T4	6 ^a	5.4 ^a	12 ^a	3.46 ^a
T5	6 ^a	5.3 ^{ab}	11 ^a	3.76 ^a
T6	6 ^a	5.3 ^{abc}	12 ^a	3.51 ^a

Table 1; Effect of six treatments on Pericarp Thickness, Brix Value, Keeping Quality and General Appearance. Values are the means of three replications.

T1 - DOA Recommendation

T2 - DOA Recommended Dosage of Inorganic fertilizer and ORSMD for Tomato

T3 - DOA Recommended Dosage of Inorganic fertilizer and ORSMD for Tomato reduced by 25%

T4 - DOA Recommended Dosage of Inorganic fertilizer and ORSMD for Tomato increased by 25%

T5 - DOA Recommendation and ORSMD for Tomato

T6- Ontario Recommendation for Tomato

Note: Means with the same letters along the columns are not significantly different at $P > 0.05$. Measurements are the means of three replications. ORSMD-Ontario recommended dosage of secondary and micro nutrients dosage.

Conclusions

The study revealed that, preharvest essential macro and micronutrient supplementations can significantly influence pericarp thickness, general appearance, brix value and keeping quality. The experiment highlights the requirements of essential macro, secondary and micro nutrient fertilizer package for tomato farming. Therefore future studies are

needed to better understanding of the relationships between macro secondary and micro nutrient with postharvest life of tomato.

References

Kirthisinghe, J.P. Kumaragamage, D. and Sultanbava F. (2007) .Evaluation of Site Specific Fertilizer Recommendation for Cauliflower (*Brassica Oleracia* L.) In Two Locations in Sri Lanka. Tropical Agriculture Research Vol 19, Pp 229-239.

Mondal, M. F. (2000). Production and Storage of Fruits (in Bangla). Published by Afia Mondal. BAUCampus, Mymensingh-2202. Pp-312.

Nyamah E. Y, Maalekuu B. K. and Oppong-skyere D, (2011) Influence of different soil amendments on postharvest performance of tomato cv. power (*Lycopersicon esculentum*, Mill).

Weerasinghe K.M.S, Balasooriya A.H.K, Ransinghe S.L and Wijethilke L.C (2012). Macro and micro nutrients on blossom end rot of tomato (*Lycopersicon esculentum* Mill.) 3rd research symposium of Rajarata University of Sri Lanka.

