Use of Refuse Tea as a Growing Medium for Hydroponically Grown Tomato (*Lycopersicon esculentum*)

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Introduction

As the vegetable cultivation in Sri Lanka is highly seasonal and mostly weather dependent, there is a surplus of vegetable production in favourable seasons and a deficit during off seasons. Tomato is one of the most popular vegetable among the farmers owing to its high potential income, even during the off season. Meantime, tomato is an essential item in Sri Lankan diet, giving a year-round high demand. The annual requirement of tomato is met mainly by open field cultivations. But the tomato cultivation during the off season is low and difficult due to bad weather conditions.

According to Weerakkody *et al.*,(2001), Controlled Environmental Agriculture (CEA) is a new demanding technology, which has been developed to minimize the influence of undesirable environmental conditions on crop production. Hydroponics, which is commonly practiced under CEA, is a cultivation method which helps to obtain good quality products with high yields. As soil less cultivation is done under hydroponics, the growing medium plays an important role in producing fruits with good qualities. However, the ideal growing media and other requirement for each crop grown under protected environments in Sri Lanka have not been studied yet in detail (Dayananda and Wahundeniya, 2001).

Coir dust is the most common growing medium used in hydroponics in Sri Lanka. As coir dust is comparatively expensive and abundantly available only in coastal areas, using coir dust for hydroponics in up country, increases the cost of production. According to the Kularathne *et al.,* (2004) as an agricultural country, Sri Lanka produces number of agricultural wastes such as coir dust, paddy husk, refused tea, paddy straw, sugar cane trash etc., which could be used as potential growing media. Therefore, refused tea is an alternative growing medium which can be used in up country areas easily, with a low cost. But, enough assessments have not been conducted yet in Sri Lanka related to refused tea as a hydroponics growing medium. Therefore, this study is an effort to assess the performances of refused tea as a growing medium for hydroponically grown tomato.

Methodology

The experiment was conducted at the *Uva Wellassa University, Badulla*, Sri Lanka during May to August 2012.There were five treatments with five replicates and they were arranged in Complete Randomized Design (CRD). Different combinations of two growing media were used as the five treatments (Table 1). A popular tomato variety, *Thilina* was used to assess the performances of different growing media mixtures.

The nursery was laid in a nursery plate using well washed and sterilized coir dust. Black polythene was used to prepare grow bags having 10 inches width and 12 inches height. Coir dust and refused tea were mixed according to the different treatment combinations (Table 1) and filled in to the grow bags. Vigorously grown healthy seedlings were transplanted to prepared grow bags by maintaining one seedling per each bag. Recommended concentrations and volumes of Albert's solution were applied depending on the growth stages of tomato.

Table 1: Treatment combinations

Treatments	Media
T1	Coir dust (CD) only
T2	Refused Tea (RT) only
T3	Coir dust (1) + Refused Tea (1)
T4	Coir dust (1) + Refused Tea (2)
T5	Coir dust (2) + Refused Tea (1)

Growth and yield parameters of the tomato plants grown under different treatment combinations were assessed during the study period. Height of the plants, number of fully opened flowers and well-formed fruits per plant, total yield per plant, width and length of the fruits, fresh weight of the roots and Brix value and pH of tomato juice were the recorded growth and yield parameters. Finally these parameters were statistically analyzed using ANOVA.

Results and Discussion

A summary of the results obtained in this study is shown in Table 2 and Table 3 with their significance levels.

Table 2: Growth and yield parameters of the plants in different treatments

Treatment	Plant height at maturity (cm)	Average number of flowers/plant	Average number of fruits/plant	Total yield/ plant (g)	Fresh weight of roots (g)
T1	135.20	34.600	10.400	198.35^{ab*}	76.44^{a}
T2	120.20	18.200	6.600	131.53^{b}	31.88^{b}
T3	133.60	53.600	13.200	307.55^{a}	64.77^{ab}
T4	136.80	35.400	10.000	244.62^{ab}	63.28^{b}
T5	141.80	40.400	11.400	226.05^{ab}	98.61^{a}
P Value	0.317	0.093	0.058	0.029	0.004

* Means with the same letter are not significantly different at $\alpha = 0.05$

According to the Table 2, there are no significant differences among the treatments for most of the parameters except the total yield and the fresh weight of roots. The highest plant height at maturity is in T5 and the lowest is in T2. However, both the highest number of flowers and fruits which have led to the highest total yield is in T3 while the lowest of those is in T2.

Table 3 reveals that, the treatments show significantly different fruit lengths at the 5%significance level. However, T3 has produced superior quality fruits having both higher fruit lengths and fruit widths, while T2 has formed smaller fruits having lower fruit widths and lengths.

Table 3: Quality parameters of the fruits in different treatments

Treatment	Average width of fruit (cm)	Average length of fruit (cm)	Brix value of juice (%)	pH of juice
T1	4.0560	4.8000[ab*]	5.1	4.32
T2	3.0120	3.3400[b]	5	4.45
T3	4.3300	5.4600[a]	5	4.25
T4	4.1200	4.8600[ab]	5	4.37
T5	4.1040	4.4800[ab]	7	4.28
P Value	0.189	0.039		

* Means with the same letter are not significantly different at $\alpha = 0.05$

The brix values of the fruits obtained in different treatments vary from 5 to 7, while the pH varied from 4.25 to 4.45. It is desirable to produce tomatoes with higher soluble solids content, because they will require less energy to evaporate water to a target final Brix content (Barrett *et al.*, 2007). The pH of fruit juice affects the time required for heating to achieve sterilization of processed commodity. Generally, the pH values above 4.5 are unacceptable for processing purposes (Wahundeniya *et al.*, 2006).But, the pH values of the fruit juice obtained from above different treatments are less than 4.5, which is acceptable for processing purposes.

Conclusion

Out of the five different growing mixtures tested, the plants grown in T3 shows better performances by providing significantly higher total yields with significantly longer fruits compared to other four mixtures. Therefore, a combination of refused tea and coir dust into 1:1 ratio could be used to produce high quality tomato with higher yields under hydroponics other than using either only coir dust or only refused tea.

References

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