African Journal of Agricultural Research Vol. 7(10), pp. 1601-1603, 12 March, 2012
Available online at http://www.academicjournals.org/AJAR
DOI: 10.5897/AJAR11.1148
ISSN 1991-637X © 2012 Academic Journals

Short Communication

A comparison between tomato quality of mature-green and red- ripe stages in soilless culture

Hassan Borji[1]* and Ghehsareh Mehrdad Jafarpour[2]

[1]Young Researchers Club, Khorasgan (Esfahan) Branch, Islamic Azad University, Isfahan, Iran.
[2]Faculty of Agriculture, Khorasgan (Esfahan) Branch, Islamic Azad University, Isfahan, Iran.

Accepted 17 January, 2012

The aim of this study was to compare between postharvest tomato quality of mature-green and red- ripe stages produced in soilless culture. The research was conducted in a completely randomized design with 3 replications. The treatments included: palmpeat 1 + perlite (v/v = 50%), palmpeat 2 + perlite (v/v = 50%), perlite (100%), palmpeat 1 (100%) (non fermentation) and palmpeat 2 (100%) (3 manth fermentation) (papadopolus formula used for nutrient solution during plant growth with fertigation method as well as temperature, humidity and irrigation rate was constant for all treatments. Comparison of means showed that the media had significant effect on fruit quality [titratable acidity (TA), total soluble solid (Tss), Vitamin C and Tss/TA]. Also results showed that the stages of harvesting (red-ripe and mature-green) had significant difference on Tss, Vit c and Tss/TA. The overall results showed that the stage of red-ripe quality of fruits is better than mature-green and its effect was selected by consumers.

Key words: Titratable acidity, total soluble solid/titratable acidity, soilless, palmpeat, perlite.

INTRODUCTION

To consumers, the flavor gains the porosity among other characters. Tomato flavor depends upon sweetness and sourness and each of them is correlated with the other. Sweetness of tomato is mainly dependent upon the levels of total sugars; reducing sugars like glucose and non-reducing sugars like sucrose. Sucrose is mostly due to level of titratable acidity (TA) like citric acid. Sureness usually masks sweetness. Hydroponic plant production has been practiced for several millennia and it permits crops to be grown where no suitable soil exists or where the soil is contaminated in some manner. In one of the seven wonders of the ancient world, the Hanging Gardens of Babylon, plants were grown in a steady stream of water. In addition, more complete control of the environmental factors that affect plant growth and yield (root environment, fertigation, light temperature, humidity, etc.) is possible. Suitable mixture of substrate in soilless culture within greenhouse systems, extend harvesting duration, out of season strawberry production and increase in yield. Material properties of substrate exhibit direct and indirect effects on plant physiology and production. There are different reports related to use of zeolite and perlite as substrates in hydroponic culture (Permuzic et al., 2003).

Kanazirska et al. (1997) reported decreasing potassium exchange in substrates of perlite and mixtures of perlite/zeolite cucumber hydroponic culture. Due to high price and not easy availability of peat moss, producers usually try to replace it by other substrates like perlite or zeolite, but in Iran there are rich natural sources of peat moss in the north of Iran and, as a result, it can be used in hydroponic systems as a cheap substrate individually or combined with perlite. Moreover, some growers prefer the soilless production on purpose due to high yield and good quality of crops. Soilless cultivation serves to improve better control of the growing medium and to avoid any likely problems for watering and maintaining proper nutrient concentrations. Good control of the plant

*Corresponding author. E-mail: hasan_soil63@yahoo.com.

Table 1. Comparison means of different harvesting of fruit quality.

	TA (%)	Tss (%)	Vitamin C (mg/100 ml)	pH	Tss/TA
Stages					
Mature-green	1.5[a]	5.1[b]	11.6[b]	4.1[a]	3.32[b]
Red- ripe	1.35[a]	6.2[a]	16.3[a]	4.56[a]	4.7[a]

Table 2. Comparison means effect of different media on fruit quality.

Treatment	Vit. C (mg/100 ml)	Tss (%)	TA (%)	pH	Tss/TA
Perlite	10.26[b]	5.08[b]	1.35[b]	4.55[a]	3.75[a]
Palmpeat 1	10.9[b]	5.26[b]	1.52[ab]	4.56[a]	3.46[a]
Palmpeat 2	10.1[c]	5.29[b]	1.65[ab]	4.65[a]	3.22[a]
Palmpeat 1 + perlite	11.51[ab]	5.07[b]	1.65[ab]	4.39[a]	3.08[a]
Palmpeat 2 + perlite	15.86[a]	5.86[a]	1.85[a]	4.57[a]	3.22[a]

growth and development in soilless cultivation of vegetables give proportionally higher yield and better quality crops compared to traditional greenhouse production in soil. This technique is mainly practiced with substrate medium. This is due to superior physical and chemical properties of the substrates and their initial low infestation rate with pathogenic pest and due to their ease of dis-infestation. Frequent irrigation and continued fertilization should satisfy nutritional plant demands under most practical situations (Raviv et al., 2002). Due to the arising problems of soil and the shortage of water supply for irrigation in Jordan, several farmers are using closed soilless cultures with the non-organic volcanic tuff as a substrate for production of cash crops such as cut flowers. Under different substrates study, no significant difference was found between open and closed systems with respect to tomato total yield (Tüzel et al., 2001). Sand culture is one of the most efficient and a cost-effective method of soilless cultures due to its relatively low construction cost, simplicity of operation, ease of maintenance and service. However, sand culture requires sterilization between crops and feed lines may be blocked with sand particles in addition to rapid salt build-up (Wright, 1992).

The aim of this study was to compare between postharvest tomato quality of mature-green and red- ripe stages produced in soilless culture.

MATERIALS AND METHODS

The experiment was conducted in green house of Islamic Azad University of Esfahan Iran in a controlled environment greenhouse (27 to 34 c/day, 18 to 20 c/night and about 75% humidity). The solution used in irrigation contained all minor and major nutrients. Cultivars were randomized in the house with three replications and 5 treatments. Treatments included: perlite, palmpeat1 (non fermentation), palmpeat2 (3 manth fermentation), perlite + palmpeat1 (50/50) and perlite + palmpeat2 (50/50). Tomato fruits were harvested at the two ripening stages; that is mature-green and red-ripe and at two picking (harvesting) times. Fruits were brought to the laboratory for biochemical analyses to estimate Tss, TA, Vit c, pH and Tss/TA of the tomato juice. Total soluble solids (Tss) were estimated by refractometer, Vit c and titratable acidity (TA) were measured by titration according to the methods of A.O.A.C (1975). E statistical analysis was performed using Mstat. C with Duncan for means comparison.

RESULTS AND DISCUSSION

The analysis of a comparison between postharvest tomato quality of mature-green and red-ripe stages and effect of different media on fruit quality were summarized in Tables 1 and 2.

Tss (total soluble solid)

Comparison of means effects of media on Tss showed that significantly difference between treatments (Table 2) and comparison means stages of harvesting had significant difference (Table 1) that was in red-ripe stage more than mature-green stage. The high concentrations of ammonium solution can reduce soluble solids (Delshad et al., 2008); increasing concentrations of macro elements resulting in increased soluble solids of tomato fruits (Lin et al., 1999).

TA (total acidity)

The effect of media on total acidity had significant difference between treatments. Maximum total acidity related to palmpeat1 + perlite treatment. Also, comparison of stages harvesting had no significant difference. Effect of the substrate on yield and fruit quality of tomato in soilless culture studied by Tzortzakis showed that plants

grown in pumice and perlite substrates obtained lower total yield; and higher yield was obtained from maize substrate. Pumice + 50% maize and 100% maize produced higher total number of fruits per plant. Fruit quality parameters such as mean of fruit weight, fruit firmness, total soluble solid, titrable acidity, ascorbic acid and carotenoids were influenced by substrates while they had no effect on EC, pH and dry matter content. The results suggested that addition of maize to perlite and pumice could improve properties of inorganic substrates for tomato soilless culture leading to higher yields and better quality fruit (Tzortzakis et al., 2008). The low level of potassium effect was on quality tomato and therefore effect on total acidity and reduction of fruit quality (Mazumdar et al., 2003).

pH

The pH had no significant difference in between treatments and various stages of harvesting. Date- palm peat1 + perlite treatment had maximum amount of pH and had significant difference at 5% level with other treatments (Borji et al., 2010).

Vitamin C (ascorbic acid)

Ascorbic acid showed that there was significant difference between treatments and various harvesting (red-ripe and mature-green). Maximum and minimum of vitamin c related to palmpeat 1 + perlite (15.86%) treatment and palmpeat 2 (10.1%) treatment, respectively.

Tss/TA

Various media effect was on Tss/TA and had significant difference between treatment and various stages of harvesting. In effect of media on fruit quality, maximum percentage of Tss/TA related to perlite (3.75) treatment. Considering the ratio of TSS/TA as an expression of fruit sweetness, maize gave the sweetest fruits. The TSS content of the fruits was inversely related to the total fruit yield per plant; the higher the yield, the lower the TSS. In accordance with the present study, Islam et al. (2002) recorded no difference between organic and inorganic substrates in TSS in tomato fruit juice. The pH and the EC of the tomato fruit juice were not significantly different in tomato cultivation with different substrates which is in accordance with it. Low pH is associated with high fruit quality and was recorded in the substrates that produced early yield (maize and pumice). The TA of the fruit juice was significantly higher in perlite + 50% maize than in maize and pumice + 50% maize, and was expressed as a percentage of citric acid (Islam et al., 2002).

Conclusion

The results generally indicated that the difference among the cultivars in the vitamin c, titrable acidity, total soluble solids of the tomato juice appeared significant. Also, results showed that quality of tomato was very effective on the selected consumers on the effect of sweetness and sourness of tomato.

REFERENCES

A.O.A.C (1975). Official Method of Analysis of the Association of Official Analytical Chemists. 12th ed. Washington D.C. 377: 378-777.

Borji H, mohammadi Ghehsareh A, Jafarpour M (2010). Effects of the Substrate on Tomato in Soilless Culture. Research J. Agri. Bio. Sci., 6(6): 923-927.

Islam S, KHan S, Ito T, Maruo T, SHinohara Y (2002). Characterization of the physico-chemical properties of environmentally friendly organic substrates in relation to rockwool. J. Horti. Sci., Biotech., 72: 143–148.

Kanazirska V, Simidtchiev HR, Chakalov K (1997). Effect of zeolite on yield and Fruit quality of glasshouse cucumbers. In: Proc. Natural Zeolites Conf. Sofia, Italy, p. 109

Mazumdar BC, Majumder K (2003). Methods on physico-chemical analysis of fruits. Daya-Publishing House. pp. 93-96.

Delshad M (2000). Effect of index nitrogen nutrient solutions in mineral nutrient greenhouse tomato. Masters Thesis Horticultural Sciences Tehran University. (in Persian).

Raviv M, Wallach R, Silber A, Bar-Tal A (2002). Substrates and their analysis. In Hydroponic production of vegetables and ornamentals (D. Savvas, and H. Passam, eds). Athens: Embryo Publications, pp. 25–101.

Tüzel IH, Tüzel Y, Gül A, Meric MK, Yavuz O, Eltez RZ (2001). Comparison of open and closed systems on yield, water and nutrient consumption and their environmental impact. Acta. Horti., 554: 221-228.

Lin WC, Glass ADM (1999). The effect of NaCl addition and macronutrient concentration on fruit quality and flavor volatiles of green house tomatoes. Acta. Hort., 481:487-493.

Wright L (1992). Sand culture. Practical Hydroponics and Greenhouses Magazine, issue (2) Jan/Feb

Permuzic Z, Bargiela M, Garci A, Rendina A (1998). Calcium, iron, potassium, phosphorous and vitamin C content of organic and hydroponic tomatoes. Hort. Sci. 33(2): 255-257.