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Efficacy of graded doses of polymers on processing quality of tomato Cv. CO-3

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Abstract

An experiment was conducted to optimize graded doses of hydrophilic polymers and its effect on processing quality parameters in tomato Cv. CO-3 at College Orchard, Horticultural College and Research Institute, Coimbatore and Sheep Research Station, Potaneri-Macheri of Salem, South India. Application of graded doses of 4.5 g of Terracottem, 15.0 g of Polyvinyl alcohol and 10.0 g of Polyacrylamide enhanced the flesh thickness, total soluble solids, ascorbic acid acidity, lycopene and shelf life of the fruit, which were not influenced significantly with further increase in doses of respective polymers.

Keywords : efficacy of hydrophilic polymers, graded doses, processing quality, tomato

INTRODUCTION

Tomato is usually in great demand to satisfy the requirement of kitchen and processing industry worldwide. The processing qualities of tomato such as flesh thickness, Total Soluble Solids (TSS), pH of juice, ascorbic acid acidity, lycopene and shelf life of the fruit are important considerations in tomato consumption and marketing (Wallace, 1986). Inadequate and improper watering may adversely affect these quality parameters. Also the scattered distribution of rainfall in India mostly influences the rate of success of rainfed tomato. An effective and planned utilization of available water or rainfall therefore, becomes one of the most essential factors in Indian agriculture specific to solanaceous vegetables such as tomato.

Hydrophilic polymers which retain more moisture and nutrients with the potentiality of releasing them would be advantageous for proper rooting and plant establishment and thereby help in obtaining quality produce. Application of hydrophilic polymers helps improve the quality by virtue of their ability to absorb and translocate essential nutrients to the developing fruits. The optimum supply of hydrophilic polymers around the root zone would have its own contribution for improving culinary quality parameters in tomato (Wallace, 1986). Hence, to optimize graded doses hydrophilic polymers and its efficacy on processing quality parameters in tomato Cv. CO-3, this study was undertaken by assessing the flesh thickness (cm), TSS (^{0}Brix), pH of juice, titrable acidity (%), ascoribic acid (mg $100g^{-1}$), lycopene (mg 100^{-1}g) and shelf life (days).

MATERIALS AND METHODS

The commercially available hydrophilic polymers *viz.,* Terracottem (TerraCottem International, Belgium), Polyvinyl alcohol (Aquatrols Corporation of America, USA) and Polyacrylamide (Viterras, Germany) were selected for the study and used as soil conditioners. These polymers are granular products which can be easily mixed with the soil. Their supersorbent polymers absorb water quickly, swell swiftly and form gel like insoluble substances, which are made up of synthetic water absorbing polymers containing soluble minerals, organic fertilizers and growth stimulators. The tomato Cv. CO-3, used in this study is a drought tolerant variety. The experiment was laid out in pot culture with completely randomized block design replicated thrice. Twenty five days old seedlings were transplanted from seed pan to earthen pots, containing one part red earth, one part sand and one part farmyard manure. The polymers were applied to the individual pots at a depth of 15 cm just before planting. The treatments included six levels each of Terracottem (1.5, 3.0, 4.5, 6.0, 7.5 and 9.0 g per plant), Polyvinyl alcohol (3.0, 6.0, 9.0, 12.0, 15.0, 18.08 per plant) and Polyacrylamide (2.5, 5.0, 7.5, 10.0, 12.5 and 15.08 per plant) besides a control. The doses of polymers were fixed on the basis of standard recommendations. The quality parameters such as TSS, Flesh thickness, Titrable acidity were estimated by following the method A.O.A.C. (1975) andthe Juice pH, Lycopene, Ascorbic acid and shelf life of the fruit were determined by adopting the method described by Sadasivam and Manickam (1996).

RESULTS AND DISCUSSION

All the quality parameters were significantly influenced by the graded doses of polymers (Table 1). The optimum dose of hydrophilic polymers based on the quality traits

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Table 1.Effect of hydrophilic polymers on quality parameters in tomato Cv. CO-3

Treatments	Name of the hydrophilic polymer	Graded doses (gram per plant)	Flesh thickness (cm)	Total soluble solids (^{0}Brix)	Juice p^H	Titrable acidity (%)	Ascorbic acid (mg 100 g-1)	Lycopene (mg 100 g-1)	Shelf life (days)
T_1	TerraCottem	1.5	0.38 ^{cd}	3.31 ^{f}	4.25 ^{cde}	0.43 ^{ef}	24.3 $^{e-h}$	4.25 ^{gh}	10.7 ^{ef}
T_2	TerraCottem	3.0	0.40 ^{bcd}	3.42 ^{de}	4.28 ^{abc}	0.45 ^{de}	24.4 $^{d-h}$	4.62 ^{be}	12.3 ^{abc}
T_3	TerraCottem	4.5	0.44 ^{a}	3.61 ^{ab}	4.31^{a}	0.49 ^{a}	25.3 $^{a-b}$	5.04 ^{a}	13.2 ^{a}
T_4	TerraCottem	6.0	0.41 ^{abc}	3.60 ^{ab}	4.30 ^{ab}	0.46 ^{bcd}	24.8 $^{c-h}$	4.99 ^{ab}	12.5 ^{abc}
T_5	TerraCottem	7.5	0.42 ^{ab}	3.59 ^{d}	4.31 ^{a}	0.46 ^{bcd}	25.0 $^{c-f}$	4.70 ^{cde}	12.9 ^{a}
T_6	TerraCottem	9.0	0.42 ^{ab}	3.59 ^{b}	4.31 ^{a}	0.47 ^{abc}	24.8 $^{c-h}$	4.87 ^{abc}	13.0 ^{a}
T_7	Polyvinyl alcohol	3.0	0.32 ^{f}	3.25 ^{f}	4.16 ^{g}	0.41 ^{fg}	24.0 ^{gh}	4.09 ^{h}	09.5 ^{h}
T_8	Polyvinyl alcohol	6.0	0.33 ^{f}	3.43 ^{de}	4.23 ^{ef}	0.42^{fg}	24.2^{fgh}	4.13 ^{h}	10.1 ^{fg}
T_9	Polyvinyl alcohol	9.0	0.34 ^{ef}	3.36 ^{ef}	4.26 $^{b-e}$	0.43^{ef}	24.7^{c-h}	4.38 ^{fg}	11.7 ^{cde}
T_{10}	Polyvinyl alcohol	12.0	0.39 ^{bcd}	3.47 ^{cd}	4.28 $^{a-d}$	0.45 ^{cd}	24.9 $^{c-g}$	4.59 ^{def}	12.6 ^{abc}
T_{11}	Polyvinyl alcohol	15.0	0.44 ^{a}	3.70 ^{a}	4.30 ^{ab}	0.48 ^{ab}	26.1 ^{a}	4.86 ^{abc}	12.8 ^{ab}
T_{12}	Polyvinyl alcohol	18.0	0.42^{ab}	3.59 ^{b}	4.29 ^{ab}	0.48^{abc}	25.4^{abc}	4.82 $^{a-d}$	12.7 ^{abc}
T_{13}	Polyacrylamide	2.5	0.35 ^{ef}	3.27 ^{f}	4.20 ^{fg}	0.42 ^{fg}	24.0 ^{h}	4.25 ^{gh}	9.7 ^{gh}
T_{14}	Polyacrylamide	5.0	0.34 ^{ef}	3.32 ^{ef}	4.24 ^{de}	0.45 ^{de}	24.4 $^{d-h}$	4.52 ^{ef}	10.9 ^{def}
T_{15}	Polyacrylamide	7.5	0.37 ^{de}	3.36 ^{ef}	4.26 $^{b-e}$	0.45 ^{cd}	24.9 $^{c-f}$	4.78 ^{bcd}	11.9 ^{bcd}
T_{16}	Polyacrylamide	10.0	0.42 ^{ab}	3.55 ^{bc}	4.29 ^{ab}	0.48 ^{ab}	25.9 ^{ab}	4.93 ^{abc}	13.2 ^{a}
T_{17}	Polyacrylamide	12.5	0.41 ^{abc}	3.53 ^{bc}	4.28 $^{a-d}$	0.47 $^{a-d}$	25.2 $^{b-e}$	4.92 ^{abc}	12.6 ^{abc}
T_{18}	Polyacrylamide	15.0	0.41 ^{abc}	3.55 ^{bc}	4.28 ^{abc}	0.47 $^{a-d}$	25.4^{abc}	4.88 ^{abc}	12.8 ^{ab}
T_{19}	control (Red earth, Sand and FYM)	1:1:1 ratio	0.31 ^{f}	3.13 ^{g}	4.18 ^{g}	0.41 ^{g}	21.9 ^{i}	4.06 ^{h}	8.9 ^{h}
Mean			**0.39**	**3.45**	**4.26**	**0.45**	**24.7**	4.62 ^{abc}	**11.8**

Values and means in a column, means followed by a common letter (s) are not significantly different at 5% level (Duncan's Multiple Range Test).

was found to be 4.5 g of TerraCottem (T_3), 15.0 g of Polyvinyl alcohol (T_{11}), and 10.0 g of Polyacrylamide (T_{16}); and the results were on par. The polymers would have facilitated the optimum supply of nutrients and translocation of metabolites to the developing fruits, as a result of improvement in physical properties of soil (Wallace, 1986), which in turn resulted in the better quality of fruits (Candilo and Silvestri,1995).

A marked increase in flesh thickness, TSS, pH of juice, ascorbic acid and lycopene was observed from the treatment T_3, T_{11}, and T_{16} could be due to the proper uptake of phosphorus (Murugan, 1990) and potassium supplied from the hydrophilic polymer along with water (Wallace, 1986) might be attributed to the enhanced photosynthetic and metabolic activities, which resulted in the synthesis of higher amounts of acids, metabolites and glucose. The reserves thus produced might have contributed to the synthesis of ascorbic acid and titrable acidity. The photosynthates that are available in excess of the required quantity for normal fruit size seemed to have been diverted to improve the TSS. Similar views on the utilization of glucose for synthesis of ascorbic acid and TSS in Cassava were reported by Ogundana *et al.* (1987).

The levels lower than the optimum dose of polymers failed to influence the fruit quality parameters. Possibly such low levels were insufficient for the proper absorption and transportation of essential elements resulting in reduced availability of water and nutrients which ultimately resulted in poor quality as opined by Wallace (1986).

The higher doses of polymers also did not significantly influence the quality traits. This could be because of spread of polymers beyond the rooting zone leading to the wastage of water and nutrients from such polymers. Azzam (1980), however, found that except for few cases, the quality parameters were increased with increased rate of application. In the present study, reduced utilization of water from the gel forming hydrophilic polymers might be the reason for non-significant results at higher doses as also observed by Ahmed and Verplancke (1994) and Al-Harbi *et al.* (1996).

Tomato, being a perishable commodity, shelf life is considered important for storage and marketing. The shelf life was influenced by different treatments in the present investigation. It is obvious from the results that TerraCottem @ 4.5g per plant (T_3), Polyvinyl alcohol @15.0 g per plant (T_{11}) and Polyacrylamide@10.0 g per plant (T_{16}) improved the shelf life comparing other treatments. This might be due to the favourable influence of optimum doses of hydrophilic polymers on shelf life of tomato as also observed by Still (1976).

The present investigation on efficacy of graded doses of three hydrophilic polymers on quality of tomato Cv. CO -3 revealed that the quality parameters such as flesh thickness, TSS, pH, titrable acidity, ascorbic acid, lycopene and shelf life of the fruit differed significantly among different treatment groups with different doses of the three polymers studied. However, favourable improvements were observed from the doses 4.5 g per plant of TerraCottem (T_3), 15.0 g per plant of Polyvinyl alcohol (T_{11}), and 10.0 g per plant of Polyacrylamide (T_{16}). From these results it can be concluded that the treatments T_3,T_{11} and T_{16} are optimum for obtaining better quality parameters in tomato.

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