Vegetable Science (2016) 43 (2) : 263-265

Short Communication

Grafting tomato on potato rootstocks and its effect on quality traits

Pardeep Kumar*, Viplove Negi, Parveen Sharma, Desh Raj, Amar Singh[1] and Binny Vats

Received: July 2016 / Accepted: December 2016

Grafting in horticultural fruit trees is a well established technique for cutting down its juvenile phase and to impart resistance against diseases and other abiotic stresses in an otherwise susceptible cultivar. Now days this technique is in widespread usage for grafting vegetable crops as well to combat biotic and abiotic stresses in addition to modifying growth and yield characteristics of the scion cultivar. A susceptible plant can be forced to behave like a resistant wild or cultivated relative by grafting the former as scion on latter. As the root system has a pivotal role in determining the overall vigour and growth characteristics of a plant, grafting certainly affects the various growth and biochemical characteristics of the scion genotype grafted on a distinct rootstock genotype. Therefore, the investigation was conducted in a naturally ventilated quonset polyhouse to study the effects of grafting on different quality traits of tomato genotypes grafted on potato rootstocks.

The study was conducted in a naturally ventilated polyhouse during September 2015 to May 2016 in a Randomized Block Design with three replications. Two indeterminate tomato hybrids [Avtar-7711 (S1) and GS-600 (S2)] were used as scions and three potato cultivars as rootstocks [Kufri Himsona (V1), Kufri Himalini (V2) and Kufri Giriraj (V3)]. Tomato plants for scions were raised three weeks before planting of potato tubers in plug-trays on soil-less media (Cocopeat:Perlite:Vermiculite in proportion of 3:1:1) to ensure uniform growth of seedlings. Potato tubers were planted in the polyhouse during the first week of September 2016. Plants were grafted in the polyhouse using two grafting techniques [Tongue grafting (G1) and Cleft grafting (G2)]. Non-grafted plants of tomato (cv. Avtar-7711) and potato (cv. Kufri Giriraj) served as controls. Marketable potato tubers and tomato fruits were obtained from each treatment at harvest for analysis of various quality traits. Potato tubers were analysed for TSS (°Brix) and starch content (%). Pericarp thickness (mm), TSS (°Brix) and ascorbic acid content (mg/100g) in tomato fruits were also estimated (Table 1). Quality traits viz. starch content in potato and ascorbic acid in tomato were estimated by standard procedures given by Clegg (1956) and Ranganna (1979), respectively. TSS levels in potato tubers and tomato fruits were recorded using a refractometer. Pericarp thickness (mm) of tomato fruits was recorded by using a Vernier caliper. All necessary cultural operations were carried out to raise a healthy crop. The data recorded for different quality traits was analyzed statistically following standard statistical procedures.

Different rootstocks, grafting methods and scions significantly affected various quality parameters in potato and tomato (Table 2). Treatment combination V1G2S2 (V1=Kufri Himsona, G2=Cleft grafting and S2=GS-600) and five other treatments recorded significantly higher TSS in potato tubers than non-grafted (control) plants (Table 1). All graft combinations recorded significantly higher starch content in potato tubers than from non-grafted (control) plants, and the highest starch content (24.58%) was recorded in treatment combination V1G1S2 (V1=Kufri Himsona, G1=Tongue grafting and S2=GS-600). The starch content values detected in the present study were much higher than those recorded by Kaur and Aggarwal (2014), who found that the average starch content of fourteen cultivars tested ranged between 11.81 to 18.50%. The higher starch content in potato tubers from grafted plants could be due to the vigorous shoot growth and increased foliage mass of scion which might have led to increased photosynthesis and higher accumulation of photosynthates in the potato tubers under protected conditions.

Maximum TSS (7.60°Brix) in tomato fruits was recorded in treatment combination V3G1S1 (V3= Kufri Giriraj,

Department of Vegetable Science and Floriculture,
CSK Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Kangra- 176 062, HP
[1]Department of Plant Pathology, CSKHPKV, Palampur, Kangra- 176 062, HP
*Corresponding author, Email: pardeepsangla@gmail.com

Table 1. Quality traits recorded for potato and tomato.

Characters / Treatments	Potato		Tomato		
	TSS (°Brix)	Starch content (%)	Pericarp thickness (mm)	TSS (°Brix)	Ascorbic acid content (mg/100g)
V1G1S1	5.07	24.41	8.23	4.80	14.16
V1G1S2	6.00	24.58	6.50	5.60	15.33
V1G2S1	5.87	23.62	6.37	4.87	13.56
V1G2S2	6.47	23.75	7.19	5.07	15.68
V2G1S1	5.60	23.17	6.80	6.27	14.91
V2G1S2	5.40	21.83	7.80	5.13	13.60
V2G2S1	5.27	21.75	7.11	5.07	14.55
V2G2S2	5.87	23.11	7.52	5.80	15.57
V3G1S1	4.60	22.68	6.17	7.60	19.66
V3G1S2	5.80	22.92	7.81	6.60	21.34
V3G2S1	6.40	22.57	6.32	4.73	13.48
V3G2S2	4.80	22.23	7.65	5.73	16.01
Control	5.40	20.36	7.14	4.53	21.28
CD (0.05)	0.36	0.09	0.19	0.45	0.13

Table 2. Effect of rootstocks, grafting methods and scions on various quality traits in potato and tomato.

Characters / Treatments	Potato		Tomato		
	TSS (°Brix)	Starch content (%)	Pericarp thickness (mm)	TSS (°Brix)	Ascorbic acid content (mg/100g)
A. Rootstocks					
Kufri Himsona (V1)	5.85	24.09	7.07	5.08	14.68
Kufri Himalini (V2)	5.53	22.47	7.31	5.57	14.66
Kufri Giriraj (V3)	5.40	22.60	6.99	6.17	17.62
CD ($P = 0.05$)	0.18	0.04	0.09	0.23	0.07
B. Grafting methods					
Tongue grafting (G1)	5.41	23.27	7.22	6.00	16.50
Cleft grafting (G2)	5.78	22.84	7.03	5.21	14.81
CD ($P = 0.05$)	0.15	0.04	0.08	0.18	0.05
C. Scions					
Avtar-7711 (S1)	5.47	23.03	6.84	5.56	15.05
GS-600 (S2)	5.72	23.07	7.41	5.66	16.25
CD ($P = 0.05$)	0.15	NS	0.08	NS	0.05

G1= Tongue grafting and S1= Avtar-7711). Davis *et al.* (2008) and Poudel and Lee (2009) also reported higher TSS in fruits produced on grafted plants. Pericarp thickness was maximum (8.23 cm) in treatment combination V1G1S1 (V1= Kufri Himsona, G1= Tongue grafting and S1= Avtar-7711). Though, Khah *et al.* (2006) reported that fruit descriptive and qualitative characteristics were not affected by grafting. Fruits produced on grafted plants were found to have lower ascorbic acid than non-grafted (control) plants (21.28 mg/100g). The reduced ascorbic acid content in fruits produced on grafted plants could be due to partitioning of assimilates and ascorbic acid between the two sinks i.e. tomato and potato, as potato tubers also contain an appreciable amount of ascorbic acid. Turhan *et al.* (2011) also found reduced ascorbic acid content in produce from grafted plants. Whereas, Gajc-Wolska *et al.* (2014) observed no significant difference for quality attributes among grafted and non-grafted plants and reported that sensory quality of the fruits were mainly affected by the harvest date and to a lesser degree, by the substrate used and grafting.

Plants grafted on rootstock Kufri Himsona (V1) recorded maximum TSS (5.85 °Brix) and starch content (24.09%) in potato tubers and those grafted on Kufri Himalini (V2) recorded highest pericarp thickness (7.31 mm) in tomato fruits (Table 2). Plants grafted on Kufri Giriraj (V3) recorded maximum TSS (6.17 °Brix) and ascorbic acid content (17.62 mg/100g) in tomato fruits. Except for TSS content in potato tubers, plants grafted with tongue grafting method resulted into maximum starch content (23.27%) in potato tubers, maximum pericarp thickness (7.22 mm), TSS (6.00 °Brix) and ascorbic acid content (16.50 mg/100g) in tomato. Plants grafted using GS-600 (S2) as scion resulted in maximum TSS (5.72 °Brix) in potato tubers, maximum pericarp thickness (7.41 mm) and ascorbic acid content (16.25 mg/100g) in tomato fruits. However, scions had no significant effect on starch content in potato tubers and TSS in tomato fruits.

References

Clegg FM (1956) The application of anthrone reagent to the estimation of starch in cereals. J Sci Food Agri 7(1): 40-44

Davis AR, Veazie PP, Hassell R, Levi A, King SR and Zhang X (2008) Grafting effects on vegetable quality. Hort Sci 43(6): 1670-1672

Gajc-Wolska J, Kowalczyk K, Marcinkowska M, Radzanowska J and Bujalski D (2014) Influence of growth conditions and grafting on the yield, chemical composition and sensory quality of tomato fruit in greenhouse cultivation. J Elementol 20(1): 73-81

Kaur S and Aggarwal P (2014) Studies on Indian potato genotypes for their processing and nutritional quality attributes. Int J Current Microbiol Appl Sci 3(8): 172-177

Khah EM, Kakava E, Mavromatis A, Chachalis C and Goulas C (2006) Effect of grafting on growth and yield of tomato (*Lycopersicon esculentum* Mill.) in greenhouse and open-field. J Appl Hort 89(1): 3-7

Poudel SR and Lee WS (2009) Response of eggplant (*Solanum melongena* L.) as a rootstock for tomato (*Solanum lycopersicum* L.). Horticulture, National Chung Hsing University 34(2): 39-52

Ranganna S (1979) Manual of analysis of fruit and vegetable products. Tata McGraw Hill Book Company, New Delhi.

Turhan A, Ozmen N, Serbeci MS and Seniz V (2011) Effect of grafting on different rootstocks on tomato fruit yield and quality. Hort Sci 38(4): 142-149