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Graft compatibility studies in interspecific tomato-potato grafts

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Abstract

An inter-specific tomato-potato graft study was undertaken in a naturally ventilated quonset polyhouse at Palampur during the autumn and winter seasons 2015. The treatments comprised of combination of two tomato hybrids [Avtar -7711 (S_1) and GS-600 (S_2)] as scions, three potato cultivars *viz.* Kufri Himsona (V_1), Kufri Himalini (V_2) and Kufri Giriraj (V_3) as rootstocks and two grafting methods *viz.* tongue grafting (G_1) and cleft grafting (G_2). GS-600 tongue grafted on Kufri Himalini ($V_2G_1S_2$) resulted in maximum survival of grafted plants (93.25%) as well as grafting success rate (81.68%). Kufri Himalini (V_2) was found to be the best rootstock for tomato scions which gave maximum survival of grafted plants (87.89%) as well as grafting success rate (76.59%). Cleft grafting (G_2) resulted in maximum survival of grafted plants (84.13%) and grafting success rate (72.95%). Tomato scion GS-600 (S_2) was found to be the best scion for potato rootstocks which resulted in a significantly higher survival of grafted plants (85.72%) and grafting success rate (73.85%) as well. Kufri Himalini+GS-600 was the best rootstock-scion combination giving maximum survival of grafted plants and grafting success rate irrespective of the grafting methods used. It is also concluded from the study that irrespective of the rootstocks and grafting methods employed, scion GS-600 (S_2) always had better survival in grafted plants and a significantly higher grafting success rate at least for the three best performing treatments and grafting tomato on potato plants in compatible combinations had a significant impact on their survival.

Key words: Pomato, Vegetable grafting, Graft compatibility, Inter-specific grafting, Solanaceae.

Grafting of vegetables to overcome various biotic and abiotic stresses is quite popular. But, these days a relatively new technology of grafting closely related crop species for production of two crops from a single plant is gaining popularity among the professionals and farmers, though the concept dates back to early 20th century. Working on this concept for years, very recently in the year 2013 a British horticultural mail order company 'Thompson and Morgan' developed a double-cropping plant 'Tomtato', which is a tomato grafted on potato rootstock. This plant is capable of producing both potatoes and tomatoes growing as a single plant after successful grafting. No such kind of research work has been done in India and the technical knowhow on such technology is hitherto unavailable. In light of this fact a study was conducted at CSK HPKV Palampur, to assess the compatibility of tomato cultivars grafted on different potato rootstocks. The valuable information generated by the present investigation will be helpful in further improvement of this technology which holds promise and offer viable and eco-friendly alternative to meet the food requirement of the people of a rapidly growing economy like India.

Materials and Methods

The experiment was laid in a Randomized Block Design inside a modified naturally ventilated quonset polyhouse during autumn-winter season of 2015. Two potential private sector tomato hybrids [Avtar-7711 (S1) and GS-600 (S2)] were used as scions. Three potato cultivars [Kufri Himsona (V1), Kufri Himalini (V2) and Kufri Giriraj (V3)] recommended for cultivation of mid-hills of Himachal Pradesh were used as rootstocks. Tomato seedlings were raised during the first week of August in soil-less media in plastic plug-trays to ensure uniform growth, which is a pre-requisite for grafting in vegetable crops. Potato tubers were sown in the polyhouse itself during the first week of September. Tomato scions were grafted on potato rootstocks using two grafting methods [Tongue grafting (G1) and Cleft grafting (G2)] as and when the plants attained graft able size. Grafting operation was successfully completed up to first week of October. Optimum conditions were maintained for successful healing of grafted component. All necessary cultural operations were followed as per package of practices to raise a healthy crop. Observations were made on plant survival characteristics and data were

recorded per plot to work out the survival of grafted plants (%) and grafting success rate (%) in the following manner:

$$\text{Survival of grafted plants (\%)} = \frac{\text{Plants survived after grafting}}{\text{Total number of plants grafted}} \times 100$$

$$\text{Grafting success rate (\%)} = \frac{\text{Plants survived till the end of trial}}{\text{Number of successful grafts}} \times 100$$

The data recorded was analyzed following the standard statistical procedure for Randomized Block Design experiments.

Results and Discussion

The analysis of variance indicated that all the grafted plants exhibited an appreciable survival percentage and grafting success rate, which ranged between 60.65-93.25% and 60.82-81.68%, respectively for different graft combinations (Table 1). Treatment combination $V_2G_1S_2$ (Kufri Himalini + Tongue grafting + GS-600) recorded maximum survival of grafted plants (93.25%) followed by treatments, V2G2S2 (Kufri Himalini + Cleft grafting + GS-600) and $V_3G_2S_2$ (Kufri Giriraj + Cleft grafting + GS-600) with plant survival of 92.33% and 88.80%, respectively. Grafting success rate recorded was maximum (81.68%) in treatment combination $V_2G_1S_2$ (Kufri Himalini + Tongue grafting + GS-600) followed by treatments, $V_2G_2S_2$ (Kufri Himalini + Cleft grafting + GS-600) and $V_3G_2S_2$ (Kufri Giriraj + Cleft grafting + GS-600) with grafting success rates of 78.43% and 76.80%, respectively. This indicates that irrespective of the rootstocks and grafting methods employed, scion GS-600 (S2) always exhibited better survival in grafted plants and a significantly higher grafting success rate at least for the three best performing treatments (Table1).

Kufri Himalini (V2) was found to be the best rootstock for tomato scions which recorded maximum survival of grafted plants (87.89%) as well as grafting success rate (76.59%). Cleft grafting (G_2) resulted in maximum survival of grafted plants (84.13%) and grafting success rate (72.95%). The tomato scion GS-600 (S_2) was found to be the best scion for potato rootstocks which resulted in a significantly higher survival of grafted plants (85.72%) and grafting success rate (73.85%) as well (Table 2). Kufri Himalini+GS-600 was the best rootstock-scion combination which recorded maximum survival of grafted plants and grafting success rate irrespective of the grafting methods used. Kufri Himalini is a high yielding mid-maturing cultivar of potato and this could be the reason that it supported a vigorous growth of tomato scion. Maximum yield of potato tubers per plant (424.33g) were recorded in Kufri Himalini (V_2), Tongue grafting (382.14g) (G_1) and plants grafted with GS-600 (S_2) scion. Marketable fruit yield of tomato was highest (0.87kg) in plants grafted on (V_2) Kufri Himalini rootstock, whereas Scion GS-600 (S_2) produced 1.28 kg marketable tomato fruit per plant (Table 2).

Maharana *et al.* (1986) found that the highest yield of tomato fruits (870 g/plant) and potato tubers (120 g/plant) were

Table 1. Interaction effect of rootstocks, grafting methods and scions on survival & grafting success rate of grafts

Characters / Treatments	Survival of grafted plants (%)	Grafting success rate (%)
V1G1S1	88.58	75.68
V1G1S2	74.48	61.99
V1G2S1	80.74	70.55
V1G2S2	79.76	68.67
V2G1S1	82.64	72.64
V2G1S2	93.25	81.68
V2G2S1	83.34	73.61
V2G2S2	92.33	78.43
V3G1S1	60.65	60.82
V3G1S2	85.72	75.55
V3G2S1	79.80	69.62
V3G2S2	88.80	76.80
Control	-	-
CD (P=0.05)	**0.20**	**0.70**

Table 2. Effect of rootstocks, grafting methods and scions on survival ,grafting success and yield of tomato and potato

Characters / Treatments	Survival of grafted plants (%)	Grafting success rate (%)	Tuber Yield /plant (g)	Marketable tomato yield /plant (kg)
A. Rootstocks				
Kufri Himsona (V1)	80.89	69.22	321.14	0.86
Kufri Himalini (V2)	87.89	76.59	424.33	0.87
Kufri Giriraj (V3)	78.74	70.70	348.50	0.75
CD (P = 0.05)	**0.10**	**0.35**	**0.45**	**0.03**
B. Grafting methods				
Tongue grafting (G1)	80.89	71.39	382.64	0.83
Cleft grafting (G2)	84.13	72.95	346.80	0.82
CD (P = 0.05)	**0.08**	**0.29**	**0.37**	**NS**
C. Scions				
Avtar-7711 (S1)	79.29	70.49	355.19	0.37
GS-600 (S2)	85.72	73.85	374.25	1.28
CD (P = 0.05)	**0.08**	**0.29**	**0.37**	**0.03**

obtained from plants grafted in December. The lowest yields were obtained from plants grafted in September. Trudgill and Thompson (1987) also reported that a vigorous rootstock supported more vigorous growth of scions. Maharana *et al*. (1990) successfully grafted tomato scion on potato rootstock and found that spraying urea (0.5%) or boron (0.2%) one month after grafting increased the growth and yield components of both species and produced yield of 714.3 - 912.6 g fruits/plant and 102-128 g tubers/plant, compared with corresponding yield of 720.6 and 96 g in the untreated control. Brandt and Kollmann (1992) found that assimilate transport across the graft interface started in the compatible tomato-potato graft earlier than non-compatible bean-sunflower graft. Tsror and Nachmias (1995) also recorded successful grafting between tomato scion and potato rootstock.

The investigation revealed that grafting tomato on potato plants in compatible combinations had a significant impact on their survival. The survival percentage of best rootstock-scion combination recorded was as high as 93.25%, indicating the close genetic relationship and a high degree of graft compatibility between potato and tomato plants. Similar observations were reported by Peres *et al.* (2005).

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