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Influence of heterografting on growth and yield characteristics of Pomato grafts

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Abstract

The present study was conducted at Vegetable Research Farm of CSK HPKV, Palampur during the year 2019-20 and 2020-21. The experimentation was designed in RCBD along with three replications. The data was worked out for various growth and yield of tomato and potato of pomato grafts. The outcomes of the investigation presented that maximum plant height (272.90 cm), number of fruits per cluster (8.20), fruit yield per pant (4.11 kg), tuber yield per square meter (5.44 kg), was calculated for the graft combinations i.e. K. Himalini + Rakshita, K. Himalini + PTH-1, K. Pukhraj + Avtar. Observations from the recorded data also proved that K. Jyoti+ Avtar and K. Jyoti + PTH-1 took minimum number of days for first flowering and days to harvest in case of tomato and potato i.e. 49.70 and 72.04. Hence, these graft combinations can be further recommended to grower, so they can fetch more yield from the limited land holding.

Key words: Pomato, graft combinations, yield, growth, tomato fruits, potato tuber.

Grafting is one of the most renowned techniques used to combat biotic and abiotic stresses in order to enhance the crop yield, productivity and quality. Pomato plant is a combination of two crops that is tomato and potato, which belong to same family and having similar basic chromosome numbers. This grafted plant showed natural compatibility and does not produce by means of sexual process. The success of any graft combination depends on establishment of vascular tissues connection amongst scion and rootstocks. This is also known as a dual-purpose crop since it can produce two crops from a single plant; tomato fruit above ground and potato tubers below ground (Kumar *et al*. 2015 and Arefin *et al*. 2019). Incompatibility, on the other hand, might result in a decrease in crop output and quality (Gisbert *et al*. 2011, Haberal *et al*. 2016). Tomato (*Solanum lycopersicum* L.) is one of the most important solanaceous vegetable crops grown worldwide due to its adaptability to a wide range of environments and high nutritional value. It has been a focal focus of the horticultural sector since the mid-nineteenth century. It is a tropical annual plant that thrives in a wide range of agro-climatic conditions. It is often recognized as a "protective food" due to its nutritive characteristics and high beta-carotene and lycopene levels. (Pooja *et al.* 2022). Tomato and potato are the two potential crops, which are not only used in bulk quantity but also for the production of various processed products. In addition to that, these two potential crops contain a significant amount of essential minerals and nutrients, which contributes to the dietary intake of human beings. Potato is a staple food next to rice, maize, and wheat, it is also known as wholesome food, contains a fair amount of dietary constituents, essential nutrients such as carbohydrate approximately 20.6%, protein, major minerals (Ca, P and Fe), vitamins particularly Vitamin B1, B2 and B3 and essential nutrients like leucine, isoleucine, and tryptophan, respectively. It contains a high amount of carbohydrates, which is easy to digest mostly boiled potato tubers are prescribed to weak person, cure from high blood pressure as it contains a small amount of sodium, effective against gum problems, cold, etc. and raw

pulp of potato is used as a good natural healer (Rick and Chetelat 1995). Hence the study was carried out to find out the best suitable graft combinations for various growth and yield parameters.

Materials and Methods

The experiments was conducted during the year 2019-20 and 2020-21, and designed in Randomized Complete Block Design and replicated thrice. Four different tomato scions were grafted onto four diverse potato rootstocks to develop sixteen pomato graft combinations. The seed sowing of tomato scions namely, Avtar, Rakshita, Heemsohna and PTH-1 was done fifteen days before the sowing of potato genotypes *i.e.* Kufri Jyoti, Kufri Khyati, Kufri Himalini and Kufri Pukhraj under the naturally ventilated polyhouse. The plot size had 3 m length and 1m of width which occupied total eighteen numbers of plants. Standard cultural practices were followed from sowing of tomato seedlings till last harvesting. The grafts were developed through cleft grafting (Kumar *et al*. 2021). All sixteen combinations along with two checks i.e. each of tomato and potato were evaluated for growth and yield related attributes. Five random plants were tagged from each plot and data was collected for various growth and yielding attributes. The analysis was done using MS-Excel sheet and OPSTAT software.

Details of different graft combinations of pomato grafts

Parental combination details	
Tomato	
Genotypes	Avtar, Rakshita, Heemsohna, Palam Tomato Hybrid -1
Potato	
Genotypes	Kufri Jyoti , Kufri Khyati, Kufri Himalini, Kufri Pukhraj
1	Kufri Jyoti + Avtar
2	Kufri Jyoti + Rakshita
3	Kufri Jyoti + Heemsohna
4	Kufri Jyoti + Palam Tomato Hybrid-1
5	Kufri Khyati + Avtar
6	Kufri Khyati + Rakshita
7	Kufri Khyati + Heemsohna
8	Kufri Khyati + Palam Tomato Hybrid-1
9	Kufri Himalini + Avtar
10	Kufri Himalini + Rakshita
11	Kufri Himalini + Heemsohna
12	Kufri Himalini + Palam Tomato Hybrid-1
13	Kufri Pukhraj + Avtar
14	Kufri Pukhraj + Rakshita
15	Kufri Pukhraj + Heemsohna
16	Kufri Pukhraj + Palam Tomato Hybrid-1
Control Genotypes	Avtar (Tomato), Kufri Pukhraj (Potato)

*The seeds of varieties/hybrids were procured from Department of Vegetable Science and Floriculture, CSK HPKV, Palampur.

Results and Discussion

Growth and yielding traits of tomato

Data showed in the Table 1 revealed that amongst all the studied pomato combinations minimum days to first flowering was noticed with K. Himalini + Avtar during the year 2019-20 whereas, lowest days for flowering was recorded with K. Jyoti + Avtar for the year 2020-21 and pooled analysis of data. However, out of all studied combinations along with check the minimum days to first flowering in both years and pooled over years was documented with control *i.e.* Avtar, respectively. The possible explanation for the studied trait might be due to phytochrome signal which is produced in the leaves and then delivered acropetally and basipetally to the subterranean sections of pomato plants via the graft union and phloem. The similar results also have been found by Giosanu *et al*. (2020), Kumar *et al*. (2021) in various graft combinations.

K. Himalini + Avtar took minimum days for first harvest followed by K. Jyoti + Avtar, K. Pukhraj + Avtar and K. Khyati + Heemsohna in 2019-20. Additionally, in the year 2020-21 and pooled over years lowest days count was noticed with K. Jyoti + Avtar followed by K. Himalini + Avtar, K. Pukhraj + Avtar in 2019-20, and for pooled over years K. Himalini + Avtar, K. Pukhraj + Avtar, K. Khyati + Heemsohna, K. Khyati + Avtar, K. Jyoti + Rakshita, K. Himalini + Rakshita and K. Himalini + Heemsohna. In comparison to control, the lowest days to first harvest

Table 1. Influence of different potato rootstock and tomato scion combinations on days to first flowering and days to first harvest of tomato

Treatment Combinations	Days to first flowering			Days to first harvest		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
Kufri Jyoti + Avtar	51.69	47.71	49.70	146.02	136.04	141.03
Kufri Jyoti + Rakshita	53.78	50.25	52.01	148.11	138.58	143.35
Kufri Jyoti + Heemsohna	54.10	50.38	52.24	148.43	138.71	143.57
Kufri Jyoti + PTH-1	55.91	53.99	54.95	150.24	142.32	146.28
Kufri Khyati + Avtar	54.21	48.93	51.57	148.55	137.26	142.90
Kufri Khyati + Rakshita	55.11	51.83	53.47	149.44	140.16	144.80
Kufri Khyati + Heemsohna	52.66	49.05	50.86	146.99	137.39	142.19
Kufri Khyati + PTH-1	58.77	55.66	57.22	153.10	143.99	148.55
Kufri Himalini + Avtar	51.55	48.08	49.82	145.88	136.41	141.15
Kufri Himalini + Rakshita	53.99	50.23	52.11	148.32	138.56	143.44
Kufri Himalini + Heemsohna	55.22	49.85	52.53	149.55	138.19	143.87
Kufri Himalini + PTH-1	57.66	51.97	54.81	151.99	140.30	146.15
Kufri Pukhraj + Avtar	52.52	48.74	50.63	146.85	137.07	141.96
Kufri Pukhraj + Rakshita	56.89	52.45	54.67	151.22	140.78	146.00
Kufri Pukhraj + Heemsohna	55.66	53.59	54.63	149.99	141.92	145.96
Kufri Pukhraj + PTH-1	58.77	54.76	56.77	153.10	143.09	148.10
Control						
Avtar	37.12	38.73	37.93	131.45	127.07	129.26
Range	37.12-	38.73-	37.93-	131.45-	127.07-	129.26-
	58.77	55.66	57.22	153.10	143.99	148.55
Mean	53.86	50.36	52.11	148.19	138.70	143.45
SE(±)	0.56	0.40	0.48	0.56	0.40	1.60
C.V.	1.81	1.37	1.60	0.65	0.50	1.93
CD at P≤ 0.05	1.62	1.15	0.98	1.60	1.15	3.26

during both years and pooled over years was observed with control *i.e.* Avtar. Because of the tension caused by the graft union healing process, early flowering results in early fruit set and a shorter time between plucking the first fruits. Similar outcomes was observed by Kumar *et al*. (2016), Bahadur *et al*. (2020), Eppakayala *et al*. (2020) and Kumari *et al*. (2020).

Data presented in Table 2 revealed that amongst the graft combinations, K. Himalini + Heemsohna had lowest internodal length in both respective years and pooled over years. On comparison of combinations with control Avtar for internodal length, out of sixteen three pomato graft combinations namely, K. Khyati + Heemsohna, K. Pukhraj + PTH-1 and K. Jyoti + PTH-1 were recorded statistically at par with control. These findings suggest that grafting has an effect on plant morphological indicators and that the integration and distribution of genetic material may have an effect on the growth characteristics of new plants grown from cuttings. Similar results, indicating that grafting increased the yield amount of grafted tomato plants and its components. These increases in overall yield of grafted tomato plants might be attributed to plant growth vigour.

From all studied graft combinations maximum plant height was recorded with K. Himalini + Rakshita in the first year of study. Similarly in second year of study, K. Khyati + Rakshita and in pooled over year Himalini + Rakshita resulted maximum value for

Table 2. Influence of different potato rootstock and tomato scion combinations on internodal length (cm) and plant height (cm) of tomato

Treatment Combinations	Internodal length (cm)			Plant height (cm)		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
Kufri Jyoti + Avtar	5.96	6.56	6.26	242.20	235.67	238.94
Kufri Jyoti + Rakshita	5.76	6.73	6.25	207.00	225.21	216.10
Kufri Jyoti + Heemsohna	5.52	6.57	6.04	137.60	169.87	153.73
Kufri Jyoti + PTH-1	6.64	6.48	6.56	211.40	201.26	206.33
Kufri Khyati + Avtar	7.12	6.46	6.79	234.90	244.47	239.69
Kufri Khyati + Rakshita	5.92	6.41	6.16	254.84	258.97	256.91
Kufri Khyati + Heemsohna	6.76	6.29	6.52	285.40	199.96	242.68
Kufri Khyati + PTH-1	6.92	6.63	6.78	249.80	254.53	252.17
Kufri Himalini + Avtar	6.46	6.25	6.36	191.40	210.97	201.19
Kufri Himalini + Rakshita	6.48	6.51	6.49	289.00	256.80	272.90
Kufri Himalini + Heemsohna	5.44	5.99	5.72	250.00	238.53	244.27
Kufri Himalini + PTH-1	6.18	6.33	6.25	236.48	216.43	226.45
Kufri Pukhraj + Avtar	6.56	6.54	6.55	239.04	251.28	245.16
Kufri Pukhraj + Rakshita	7.84	6.89	7.36	282.26	227.15	254.71
Kufri Pukhraj + Heemsohna	6.24	6.23	6.23	234.80	181.42	208.11
Kufri Pukhraj + PTH-1	6.78	6.34	6.56	202.20	200.13	201.17
Control						
Avtar	7.00	6.65	6.83	262.80	292.80	277.80
Range	5.44-	5.99-	5.72-	137.60-	169.87-	153.73-
	7.84	6.89	7.36	289.00	292.80	277.80
Mean	6.45	6.46	6.45	235.95	227.38	231.66
SE(±)	0.08	0.15	0.13	3.76	2.69	3.50
C.V.	2.22	3.90	3.36	2.76	2.05	2.62
CD at P≤ 0.05	0.24	0.42	0.25	10.82	7.76	7.13

character. Such findings suggest that grafting will have an impact on plant morphological characteristics and that the assimilation and distribution of genetic information will have an impact on the growth characteristics of new plants propagated from cuttings. The similar result also has been found by Sonia *et al*. (2011), Panahandeh *et al*. (2020), and Kumar *et al*. (2021).

It is very much clear form all the sixteen combinations that K. Khyati + PTH-1 graft was worked out with highest number of fruit per cluster during both years and pooled over years as presented in table 3. One graft combination namely, K. Himalini + Avtar was found to be statistically at par with maximum valued combination in 2019-20. How so ever, in 2020-21 K. Khyati + PTH-1 was followed by K. Himalini + PTH-1 and K. Khyati + Heemsohna, but in pooled over years none of the grafts were found with comparable values. Besides this, K. Pukhraj + PTH -1 was performed at par with control, also four graft combinations namely, K. Khyati + PTH-1, K. Himalini + Avtar, K. Khyati + Heemsohna and K. Himalini + PTH-1 were performed best over control in pooled over years. Plants with greater endogenous CK levels have a greater capability for tuber growth. The antagonistic activity of these two hormones is thought to be reduced in pomato plants due to the hormonal activity contributed to tuber and fruit development. These findings are in line with results of Arefin *et al*. (2019) and Giosanu *et al*. (2020).

Within interactions the highest value for fruit yield per plant was observed with combination K. Pukhraj + Avtar in both consecutive years and pooled over years. In context to the comparison of combinations with

Table 3. Influence of different potato rootstock and tomato scion combinations on number of fruit per cluster and number of fruits per plant of tomato

Treatment Combinations	Number of fruits per cluster			Fruit yield per plant (kg)		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
Kufri Jyoti + Avtar	4.80	5.08	4.94	3.37	3.49	3.43
Kufri Jyoti + Rakshita	7.80	6.15	6.98	2.94	3.11	3.02
Kufri Jyoti + Heemsohna	6.40	6.53	6.47	2.41	2.46	2.44
Kufri Jyoti + PTH-1	7.20	6.67	6.93	2.28	2.22	2.25
Kufri Khyati + Avtar	6.20	7.07	6.63	3.07	2.08	2.57
Kufri Khyati + Rakshita	6.60	7.00	6.80	2.09	2.04	2.06
Kufri Khyati + Heemsohna	7.20	7.27	7.23	2.62	2.00	2.31
Kufri Khyati + PTH-1	8.80	7.60	8.20	3.30	3.06	3.18
Kufri Himalini + Avtar	8.60	7.00	7.80	2.34	2.05	2.19
Kufri Himalini + Rakshita	5.80	6.59	6.19	2.44	2.30	2.37
Kufri Himalini + Heemsohna	5.80	6.08	5.94	2.32	2.35	2.34
Kufri Himalini + PTH-1	6.80	7.42	7.11	2.70	2.87	2.79
Kufri Pukhraj + Avtar	5.80	7.14	6.47	4.09	4.13	4.11
Kufri Pukhraj + Rakshita	6.60	6.31	6.45	3.64	3.67	3.66
Kufri Pukhraj + Heemsohna	6.20	6.60	6.40	3.27	3.13	3.20
Kufri Pukhraj + PTH-1	6.40	7.00	6.70	2.34	2.46	2.40
Avtar	5.80	8.20	7.00	4.32	4.20	4.26
Range	4.80- 8.80	5.08- 8.20	4.94- 8.20	2.09- 4.32	2.00- 4.21	2.06- 4.26
Mean	6.64	6.81	6.72	2.91	2.80	2.86
SE(±)	0.13	0.15	0.16	0.07	0.18	0.14
C.V.	3.51	3.81	4.24	3.97	11.04	8.34
CD at P≤ 0.05	0.39	0.43	0.33	0.19	0.51	0.28

control, the control "Avtar" produced higher fruit yield per plant, which was at par with the yield of combination K. Pukhraj + Avtar during the year of 2020-21 and pooled over years as presented in table 3. Assimilate partitioning occurs for both tomato fruits and storage tubers when it comes to pomatoes. The findings were in conformity with Panahandeh *et al*. (2020) and Kumar *et al*. (2021).

Growth attributes and yielding traits of potato

Data shown in Table 4 for days to 50 % emergence represented that within graft interactions developed via uniting four different kinds of potato rootstock and tomato scion, during the first year of study, K. Jyoti + Rakshita was observed with lowest number of days to 50 % emergence. Additionally in second year of study K. Pukhraj + PTH-1 was found at par to three different graft interactions *viz*., K. Khyati + Avtar, K. Khyati + PTH-1 and K. Pukhraj + Avtar. The pooled mean data for both years also gave the minimum days value with K. Khyati + Avtar. All this may be linked to the scion's strong branch growth and improved leaf mass that may have resulted in enhanced photosynthesis and higher photosynthates buildup under protected circumstances, resulting in early emergence of potato shoots Kumar *et al*. (2016).

Out of all sixteen graft interactions the combination of K. Himalini + Avtar took lowest days to attain graftable size in 2019-20, whereas in 2020-21 another two different graft interaction *i.e.* K. Khyati + Avtar and K. Pukhraj + Rakshita took least days to attain graftable size. Similarly were the results for pooled mean of both years the data interpreted in Table 4. As per researchers, grafting is a technique that uses leaf-derived signalling to promote early plant

Table 4. Influence of different potato rootstock and tomato scion combinations on days to 50% emergence and days to attain graftable size of potato

Treatment Combinations	Days to 50% emergence			Days to attain graftable size		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
Kufri Jyoti + Avtar	18.00	15.47	16.73	28.00	24.40	26.20
Kufri Jyoti + Rakshita	19.42	18.00	18.71	28.33	23.27	25.80
Kufri Jyoti + Heemsohna	16.67	14.60	15.63	23.67	22.93	23.30
Kufri Jyoti + PTH-1	14.67	13.27	13.97	25.00	18.87	21.93
Kufri Khyati + Avtar	14.33	10.27	12.30	27.33	18.73	23.03
Kufri Khyati + Rakshita	19.61	17.13	18.37	27.33	24.79	26.06
Kufri Khyati + Heemsohna	17.67	18.13	17.90	26.67	22.77	24.72
Kufri Khyati + PTH-1	17.33	10.27	13.80	23.67	20.60	22.13
Kufri Himalini + Avtar	17.00	14.20	15.60	22.33	21.47	21.90
Kufri Himalini + Rakshita	16.67	13.87	15.27	23.00	25.06	24.03
Kufri Himalini + Heemsohna	16.00	13.60	14.80	23.67	19.40	21.53
Kufri Himalini + PTH-1	16.33	13.47	14.90	23.67	21.56	22.61
Kufri Pukhraj + Avtar	15.67	10.87	13.27	25.00	19.93	22.47
Kufri Pukhraj + Rakshita	15.33	11.53	13.43	25.00	18.73	21.87
Kufri Pukhraj + Heemsohna	17.00	12.87	14.93	25.33	22.67	24.00
Kufri Pukhraj + PTH-1	15.03	10.00	12.52	22.67	18.83	20.75
Control						
Kufri Pukhraj	15.00	15.13	15.07	-	-	-
Range	14.33-19.42	10.00-18.13	18.71-12.30	22.33-28.33	18.73-25.06	20.75-26.20
Mean	16.57	13.69	15.13	24.86	21.61	23.24
SE(±)	1.05	0.39	0.85	1.42	1.41	1.43
C.V.	10.94	4.99	9.74	9.90	11.34	10.67
CD at P≤0.05	3.02	1.14	1.73	4.09	4.08	2.91

development by diverting photo-assimilates to shoot size in order to achieve graftable size. Kumar *et al*. (2021) also confirmed the same for studied trait.

On comparison of all sixteen distinct combinations of pomato the highest number of shoots per plant was registered with K. Himalini +Avtar in 2019-20, K. Pukhraj + Avtar in 2020-21 and pooled over years. K. Pukhraj when compared to sixteen different graft combinations of pomato during 2019-20 was found statistically at par with eight interactions of potato rootstocks and tomato scions *i.e.* K. Khyati + PTH-1, K. Pukhraj + Avtar , K. Jyoti + Avtar, K. Pukhraj + PTH-1. K. Pukhraj + Rakshita, K. Khyati + Avtar, K. Jyoti + PTH-1 and K. Jyoti+ Rakshita, also three graft interactions were showed their superiority over control *viz*., K. Himalini + Avtar, K. Jyoti + Heemsohna, K. Himalini + PTH-1 (Table 5). These findings are in close conformity of Mehara *et al*. (2018) and Kumar *et al*. (2021).

In context to the comparison amongst graft unions the highest number of sprout per tuber was noted with K. Jyoti + Rakshita and K. Pukhraj + Heemsohna. A sole potato plant of K. Pukhraj was found at par with three distinct combinations namely, K. Khyati + PTH-1, K. Jyoti + Heemsohna and K. Pukhraj + PTH-1, also two of the combination namely, K. Pukhraj + Heemsohna and K. Jyoti + Rakshita were resulted better over control in 2019-20. During the pooled mean performance of years K. Jyoti + Heemsohna, K. Jyoti + Rakshita, K. Pukhraj + Heemsohna were statistically at par and K. Pukhraj + PTH-1, K. Pukhraj + Rakshita, K. Jyoti + PTH-1 were performed better than of control as presented in table 5. This could be owing to stronger source sink relationships including

Table 5. Influence of different potato rootstock and tomato scion combinations on number of shoots per plant and number of sprout per tuber of potato

Treatment Combinations	Number of shoots per plant			Number of Sprout per tuber		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
Kufri Jyoti + Avtar	2.88	2.43	2.66	2.20	5.20	3.70
Kufri Jyoti + Rakshita	2.65	2.38	2.51	2.67	5.27	3.97
Kufri Jyoti + Heemsohna	3.24	2.61	2.92	2.33	5.67	4.00
Kufri Jyoti + PTH-1	2.73	2.39	2.56	2.47	6.00	4.23
Kufri Khyati + Avtar	2.75	2.67	2.71	2.27	3.80	3.03
Kufri Khyati + Rakshita	2.55	2.51	2.53	1.73	3.53	2.63
Kufri Khyati + Heemsohna	2.43	2.57	2.50	2.20	3.40	2.80
Kufri Khyati + PTH-1	2.96	2.53	2.74	2.37	3.20	2.78
Kufri Himalini + Avtar	3.33	2.46	2.89	2.20	3.47	2.83
Kufri Himalini + Rakshita	2.52	2.49	2.51	2.00	3.07	2.53
Kufri Himalini + Heemsohna	2.35	2.15	2.25	2.13	3.27	2.70
Kufri Himalini + PTH-1	3.16	2.53	2.85	2.00	4.00	3.00
Kufri Pukhraj + Avtar	2.93	3.07	3.00	1.93	5.20	3.57
Kufri Pukhraj + Rakshita	2.77	2.40	2.59	2.40	5.93	4.17
Kufri Pukhraj + Heemsohna	2.40	2.47	2.43	2.67	5.00	3.83
Kufri Pukhraj + PTH-1	2.82	2.47	2.65	2.33	6.07	4.20
Control						
Kufri Pukhraj	3.14	3.73	3.44	2.60	5.60	4.10
Range	2.35-3.33	2.15-3.73	2.25-3.44	1.73-2.67	3.07-6.07	2.53-4.23
Mean	2.80	2.58	2.69	2.26	4.57	3.42
SE(±)	0.20	0.15	0.19	0.10	0.15	0.14
C.V.	12.31	10.40	12.42	7.85	5.57	7.13
CD at P≤ 0.05	0.57	0.45	0.39	0.30	0.42	0.29

hormone exchange, as well as advantageous environmental conditions. Phytohormones offer an important role in the growth of fruits and tubers. These findings are in close conformity of Zhang and Guo (2018) and Kumar *et al*. (2021).

For days to harvest, in comparison of sixteen different graft interactions during the first years of investigation graft combination of K. Pukhraj + Heemsohna harvested earlier whereas in second year K. Pukhraj + Avtar took least days for harvesting and found at par with K. Pukhraj + Heemsohna, K. Khyati + Rakshita. As per pooled mean data analysed for both years reported that the minimum value was noticed with K. Pukhraj + Avtar was followed by K. Pukhraj + PTH-1 and K. Pukhraj + Rakshita. In continuation to this, pooled mean performance of both years demonstrated that K. Himalini + PTH-1, K. Jyoti + Avtar and K. Jyoti + PTH-1 while the others were found superior over control as presented in table 6. This might be because the four potato rootstocks adopted in this research did not adhere to the same maturity group, resulting in varied tuber maturation times. As a result, substantial disparities in potato harvest length were detected. Above discussed results are in the conformity with Bahadur *et al*. (2020) and Mehara *et al*. (2018).

In comparison of potato control (K Pukhraj) with sixteen diverse combinations of pomato, K. Pukhraj + Avtar produced highest tuber yield per square meter than of control was found at par to one of the graft combination namely, K. Jyoti + Avtar in 2019-20, K. Khyati + Heemsohna in 2020-21 and pooled over years in table 6. Besides this, thirteen of the other graft combinations except K. Jyoti + Avtar, K. Jyoti +

Table 6. Influence of different potato rootstock and tomato scion combinations on days to harvest and tuber yield per square meter (kg) of potato

Treatment Combinations	Days to harvest			Tuber yield per square meter (kg)		
	2019-20	2020-21	Pooled	2019-20	2020-21	Pooled
Kufri Jyoti + Avtar	85.20	88.33	86.77	2.47	2.95	2.71
Kufri Jyoti + Rakshita	83.73	86.67	85.20	3.07	3.12	3.10
Kufri Jyoti + Heemsohna	90.10	93.33	91.72	1.89	2.18	2.03
Kufri Jyoti + PTH-1	74.10	70.00	72.05	1.59	1.37	1.48
Kufri Khyati + Avtar	80.12	81.67	80.89	2.63	3.49	3.06
Kufri Khyati + Rakshita	84.60	86.67	85.63	5.12	3.69	4.41
Kufri Khyati + Heemsohna	87.20	90.00	88.60	2.64	2.05	2.34
Kufri Khyati + PTH-1	73.40	71.67	72.53	2.98	2.78	2.88
Kufri Himalini + Avtar	85.40	85.00	85.20	3.29	4.01	3.65
Kufri Himalini + Rakshita	81.20	86.67	83.93	5.17	5.02	5.09
Kufri Himalini + Heemsohna	75.90	78.33	77.12	3.71	5.09	4.40
Kufri Himalini + PTH-1	77.10	76.67	76.88	4.95	5.23	5.09
Kufri Pukhraj + Avtar	88.60	90.00	89.30	5.65	5.24	5.45
Kufri Pukhraj + Rakshita	80.10	83.33	81.72	4.58	4.21	4.39
Kufri Pukhraj + Heemsohna	85.99	86.67	86.33	3.05	4.30	3.68
Kufri Pukhraj + PTH-1	85.10	91.60	88.35	2.82	2.69	2.75
Control						
Kufri Pukhraj	-	-	-	2.47	2.45	2.46
Range	73.40-90.10	70.00-93.33	72.05-91.72	1.59-5.65	1.37-5.24	1.48-5.45
Mean	77.52	79.21	78.37	3.42	3.52	3.47
SE(±)	1.07	0.69	0.95	0.14	0.16	0.15
C.V.	2.40	1.51	2.11	7.18	8.02	7.55
C.D. at P≤0.05	3.09	2.00	1.94	0.41	0.47	0.31

Heemsohna and K. Jyoti + PTH-1 during first year of study, K. Jyoti + Heemsohna, K. Jyoti + PTH-1 and K. Khyati + Heemsohna were showed their superiority over the control in second year of study and for pooled data. Differences in tuber size, plant spacing and other factors may have contributed to measured yield variations between many varieties and environments (Tessema *et al*. 2020).

Conclusion

Vegetable grafting is an alternative technique mostly performed to combat various biotic and abiotic stresses to get higher productivity by using vigorous rootstocks. Similarly the pomato plant is also developed by means of vegetable grafting, which produce fruit on the above portion of ground and tubers at ground portion of plant. This grafted plant is a heterograft, where tomato scion grated onto potato rootstock, were both the crops belongs to same family and share similar basic chromosome number. From the present investigation of heterografting of tomato and potato, it could be concluded that Kufri Pukhraj + Avtar and Kufri Pukhraj + Rakshita were found to be best performing graft combinations for growth and yield traits of tomato and potato harvested from pomato plant. Hence, these graft combinations could be recommended to farmers to achieve maximum productivity and higher profits from limited agricultural landholdings.

Conflict of interest: The authors declare that there is no conflict of interest in this research paper.

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