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PERFORMANCE OF SOFT WOOD GRAFTING OF DASHEHARI MANGO ON VARIOUS ROOTSTOCKS

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ABSTRACT

Present experiment conducted at Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh, India during 2023-24 was planned to provide empirical data on the performance of different rootstocks when grafted with Dashehari scion of mango offering valuable insights for mango growers, horticulturists and researchers in Lucknow and similar mango-growing regions. The study focused on evaluating the performance of six different rootstocks, namely- Mallika, Langra, Amrapalli, Ramkela, Lucknow Safeda and Fazli, when grafted with Dashehari scion. Experiment was designed with 6 treatments and four replications following randomized block design. Soft wood grafting was performed with standard procedures selecting proper rootstock and scion. The desired observations like survivability percentage, leaf emergence, leaf area, number of leaves, length and girth of scion and rootstocks and plant height recorded and statistical analysis revealed that performance of Dashehari scion varied on different rootstock under study. Higher survivability, better new leaf growth, more girth of scion and rootstock was noticed when Dashehari scion soft wood grafted over Fazli rootstock followed by Langra under subtropical climate of Lucknow. However, soft wood grafting of Dashehari over Langra rootstock was found better for early leaf emergence, a greater number of leaves, higher plant height, better length of rootstock and scion.

Key words : Mango, Soft wood grafting, Scion, Rootstock, Dashehari.

Introduction

Mango (*Mangifera indica* L.) is an ever-green fruit crop belongs to the family Anacardiaceae originating in South East Asia, especially Eastern India, Burma and Andaman Island (Honja, 2014) and is grown in Indian sub-continent for well over 4000 years (De Candolle, 1984). It is also called as “king of fruit” and it is the “national fruit of India”. Most of the Indians like this fruit due to its attractive appearance and very pleasant taste of selected cultivars. Ripe Mango fruits are rich in vitamin A (4800 IU) vitamin B, and moderate Level of vitamin C (13mg/100g pulp) and have many essential minerals like potassium, Sodium (Mukherjee and Litz, 2009). India is the major producer of mango in the world with an area of 2400 thousand hectare with production of 21.79 million MT. In Uttar Pradesh total area under Mango cultivation is about 2.64 Lakh hectare and production about 35-45 Lakh MT (Anonymous, 2023). Mango is one of the most economically important fruit crops in India, contributing significantly to the country’s horticultural economy and cultural heritage. With its diverse agro-climatic conditions, India boasts a wide array of mango varieties, each with its unique flavor, aroma, and texture. Among the multitude of mango cultivars, Dashehari stands out as one of the traditional favorites, renowned for its sweet taste and exquisite aroma in northern part of India. However, despite its popularity, Dashehari, like many other mango varieties, faces challenges related to inconsistent yields, susceptibility to pests, diseases and adaptability to varying environmental conditions. In the quest to address these challenges and optimize mango cultivation practices, researchers and horticulturists have turned to grafting techniques as a means to enhance the performance of mango trees. Grafting, a centuries-old horticultural practice, involves joining the tissues of two different plant varieties, namely the scion (upper part of the graft) and

the rootstock (lower part of the graft), to create a single, composite plant. Soft wood grafting, in particular, has gained popularity due to its simplicity, effectiveness, and ability to facilitate the propagation of desirable mango varieties onto compatible rootstocks.

The city of Lucknow, located in the fertile plains of the Ganges basin in northern India, is renowned for its rich cultural heritage and historical significance. Moreover, Lucknow's favorable agro-climatic conditions, characterized by hot summers and moderate winters, provide an ideal setting for mango cultivation. However, despite its conducive environment, mango growers in Lucknow encounter various challenges related to orchard management, including the selection of suitable rootstocks to ensure optimal growth, productivity and fruit quality.

Several studies have highlighted the importance of rootstock selection in mango cultivation and its impact on tree growth, fruit yield, and quality. Research conducted by Singh *et al.* (2017) demonstrated the influence of rootstock on the growth and productivity of mango trees, with significant variations observed among different rootstock-scion combinations. Similarly, studies by Kumar *et al*. (2012) emphasized the role of rootstock in determining fruit quality parameters such as fruit size, weight, sugar content and shelf life. Significance of soft wood grafting in mango propagation and orchard management has been widely recognized by researchers and horticulturists (Yadav *et al.*, 2019). However, despite the growing body of research on mango grafting and rootstock selection, there remains a paucity of studies specifically focusing on the application of soft wood grafting techniques in mango cultivation under Lucknow's unique agro-climatic conditions.

This manuscript seeks to address this gap by providing empirical data on the performance of different rootstocks when grafted with Dashehari scion, thereby offering valuable insights for mango growers, horticulturists, and researchers in Lucknow and similar mango-growing regions. The present paper aimed to address these challenges by investigating the efficacy of soft wood grafting in mango cultivation under Lucknow's specific environmental conditions. The study focuses on evaluating the performance of six different rootstocks, namely Mallika, Langra, Amrapalli, Ramkela, Lucknow Safeda and Fazli, when grafted with Dashehari scion. These rootstocks were selected based on their reputed characteristics such as vigor, disease resistance, adaptability to local soil conditions, and compatibility with Dashehri scion. The selection of appropriate rootstocks is critical as it can significantly influence various aspects of mango cultivation, including tree growth, fruit yield, quality, and overall orchard productivity. For instance, Mallika is known for its dwarfing effect, which can help in orchard management and harvesting operations, while Lucknow Safeda is prized for its vigor and adaptability to a wide range of soil types. Fazli is a regular bearer while Langra is alternate bearing variety. Amrapali a dwarf, regular precocious bearer and suitable for nectar making while Ramkela is suitable for pickle making. By grafting Dashehri scion onto these diverse rootstocks, this study aims to assess their compatibility, growth patterns, and overall performance under Lucknow's environmental conditions.

Materials and Methods

The experiment was conducted at Horticulture Research Farm, Department of Horticulture, Babasaheb Bhimrao Ambedkar University, Lucknow, Uttar Pradesh, India situated at 26°76' North latitude 80°92' East longitude, 123 meter above the mean sea level. The climate of this area is typically subtropical with cool, dry winters from mid of November to February and dry, hot summers from last of April to June. The rainy season is from July to mid-September with an average rainfall of 850 mm in 2022 and 990 mm in 2023. The maximum temperature varies from 25°C to 42°C during summer, while minimum temperature varies from 6°C to 25°C during winter. The average relative humidity (RH) of Lucknow is around 69% although it varies from around 46% during summer to 86% during the monsoon. The most humid month of the year is August with humidity varies from 56.0 % to 99.6%. The least humid months of the year are April to June with RH varies from 17.5% to 92.5%. The soil of the experimental field was light alluvial having sandy loam texture and slightly alkaline nature with soil pH 8.2, with uniform topography. The experiment consisted of six rootstocks (Langra, Lucknow Safeda, Mallika, Amrapali, Fazli and Ramkela) considered as six treatments and was grafted by one scion of Dashehari cultivar with four replication following Randomised Block Design. Healthy and uniform mango stones were collected from mango pulp for Langra, Lucknow Safeda, Mallika, Amrapali, Fazli, and Ramkela and treated with sting @ 2% contains carbendazim to avoid any fungal diseases. As the stone have low viability, they were immediately planted at 20 cm ×25 cm distance and 2 to 3 cm deep in raised beds and covering with mixture of soil and farm yard manure (2:1).

Selection of scion

Mature mango cv. Dashehari trees grown on Horticulture Research Farm of Babasaheb Bhimrao

Ambedkar University, School of Agricultural Sciences and Technology, Lucknow were selected as mother plant for scion. Mature and healthy terminal shoots of coppery brown colour were tagged for preparation of scion in mango mother plants cv. Dashehari. Straight, uniform, round and having prominent terminal or side bud. Only healthy prominent terminal sticks with pencil size thickness and free from pest and diseases were selected. Tagged terminal shoots were pre-curing by clipping of leaves, leaving behind petiole stubs. Pre-curing was done 8-10 days before grafting. The tree scion shoots were collected from mother trees in the morning time on the day of grafting. Mature and healthy scion having pencil size thickness and 10 to 15 cm length were selected. Immediately after separation of the scion from the mother tree, they were wrapped in wet gunny bags to conserve moisture and carried in grafting polythene covers to the site of grafting.

Grafting method

For softwood grafting, the top growth of rootstock just above the actively growing point was decapitated with the help of grafting knife. The girth of rootstock in that region is almost similar to the scion. After that, 'V' shape slit of 3 to 5 cm length was given on terminal trimmed rootstock. A scion having same thickness as rootstock was selected. It should be 10-15 cm long. The lower end of scion was cut into gently into wedge shape of about 3 to 4 cm by the bark and little wood from two opposite sides. The wedge shape scion fit into 'V' slit on the rootstock taking care to ensure the cambium layer of stock and scion were in perfect contact to each other. The graft joint was secured by wrapping material like 1.5 cm wide and 35 cm long, 200-gauge grafting tape to avoid contamination or desiccation of the scions by maintaining humidity near and above graft union. The stone were sown in the 20th July 2023 and seedlings were ready for grafting on particular date as per programme from August to early September 2023.

To ensure the optimum moisture level, watering was done using water cane as per requirement. Polythene bag was used to cover the graft union to retain moisture. There was an incidence of leaf eating caterpillar during the experiment period. Hence, dimethoate 30 EC or Methyl demeton25 EC @ 2ml/lit was applied as and when required. Spraying of 1% KNO_3 was also carried out for remedy against potassium deficiency. Fencing was done to protect grafts against wild animals.

The data on various observation were recorded during the course of investigation were statistically analyzed using Randomized Block Design. The appropriate standard error of mean (SEm ±) and the critical difference (C.D.) at 0.05 level was worked out for the effect which was significant and the result were depicted graphically were ever necessary.

Results and Discussion

Survival of grafts (%)

The differences in survival of grafts percentage among different rootstocks with same scion found to be significant (Table 1). Fazli variety recorded the highest (92.09%) graft survival percentage followed by Langra (89.27%), Lucknow Safeda (87.38%), Amrapali (84.39%), Mallika (80.49%) and lowest (78.67%) graft survival percentage was recorded in Ramkela at 30 days after grafting. At 120 days after grafting the highest (88.36%) graft survival percentage was recorded in Fazli rootstock. The lowest (75.34%) graft survival percentage was recorded in Ramkela variety. At 240 days after grafting the highest (85.45%) graft survival percentage was also recorded in Fazli variety and the lowest (72.66%) graft survival percentage was recorded in Ramkela variety. In Fazli variety, maximum survival of grafts (92.09, 88.36 and 85.44%) were recorded in 30, 120 and 240 days after grafting, respectively as compared to other variety survival of grafts. This may be due to higher cambial activity of softwood in the Fazli rootstock. Similar variation respect to graft survival of mango was also reported by Alam *et al.* (2006), Prasanth *et al.* (2007) and Singh *et al.* (2012).

Days taken to first leaf emergence after grafting

Earliest leaf emergence (Table 1) was seen (10 days) in Langra grafts, whereas, maximum number of days taken to first leaf emergence (delay) was noticed in Fazli (13.33 days) rootstock followed by Amrapali (13 days), Lucknow Safeda (12 days), Mallika (11.66 days) and Ramkela (10.33 days). Minimum days taken for first leaf emergence in Langra grafts may be due to high meristematic activity and also due to optimum weather conditions prevailing during that period which led to early sprouting. On the other hand, more days taken for sprouting due to slow callus formation and slow initiation of subsequent growth. This fact was consistent with the findings of Sharma and Tiwari (1995) and Prashanth *et al*. (2007) on mango.

Rootstock length

Significant difference in rootstock length was recorded in rootstock length at 30, 60, 90, 120, 180 and 240 days after grafting. The maximum rootstock length was recorded in Langra (39.18 cm) followed by Mallika (36.31 cm), Fazli (33.27 cm), Ramkela (31.29 cm) and

Table 1 : Effect of various rootstocks on leaf emergence of Dashehari scion.

Treatment/Rootstock	Survival of grafts (%)			Days taken to first leaf emergence
	30 DAG	120 DAG	240 DAG	
T_1 - Langra	89.27	85.59	81.45	10.00
T_2 - Lucknow Safeda	87.38	83.49	79.79	12.00
T_3 - Mallika	80.49	78.69	76.45	11.66
T_4 - Amrapali	84.39	80.51	78.24	13.00
T_5 - Fazli	92.09	88.3	85.44	13.33
T_6 - Ramkela	78.67	74.34	72.66	10.33
SEm ±	0.077	0.117	0.125	0.621
C.D. (p=0.05)	0.247	0.374	0.399	1.981

DAG- days after grafting.

Table 2 : Change in length and girth of various rootstocks using Dashehari as scion.

Treatment/ Rootstock	Rootstock length (cm)						Girth of rootstock (mm)					
	30 DAG	60 DAG	90 DAG	120 DAG	180 DAG	240 DAG	30 DAG	60 DAG	90 DAG	120 DAG	180 DAG	240 DAG
T_1 - Langra	22.78	29.98	33.24	35.23	36.78	39.18	6.94	7.03	7.23	7.54	7.74	8.29
T_2 - Lucknow Safeda	19.35	23.23	25.87	26.91	49.19	30.44	6.5	6.63	6.62	7.07	7.41	7.83
T_3 - Mallika	22.33	28.70	31.20	33.33	34.20	36.31	6.63	6.95	7.04	7.31	7.43	7.9
T_4 - Amrapali	19.11	21.64	23.79	25.36	27.33	28.67	6.19	6.44	6.83	7.39	7.67	8.09
T_5 - Fazli	22.14	26.73	28.79	30.18	32.12	33.27	6.96	7.09	7.49	7.87	7.93	8.6
T_6 - Ramkela	20.01	23.63	27.24	27.85	30.19	31.29	5.92	6.23	6.43	7.02	7.28	7.44
SEm ±	0.059	0.102	0.061	0.203	0.078	0.070	0.027	0.008	0.011	0.006	0.064	0.010
C.D. (p=0.05)	0.190	0.327	0.194	0.249	0.137	0.224	0.085	0.025	0.035	0.020	0.206	0.031

Lucknow Safeda (30.44 cm), while, the minimum was recorded in Amrapali (28.67 cm) variety at 240 days after grafting (DAG). Langra variety recorded maximum rootstock length (22.78, 29.98 ,33.24, 35.23, 36.78 and 39.18 cm) at 30, 60, 90, 120, 180 and 240 DAG, respectively as compared to other variety (Table 2). Langra recorded highest of rootstock length (39.18 cm) among varieties due to less time taken to first leaf emergence, thus, there was increased rootstock growth due to better contact of cambium layers of stock and scion along with improved physiological processes as well as more time available for growth of meristematic cells. These results are in agreement with those of Mulla *et al*. (2011 & 2017) and Singh *et al*. (2014), who recorded the maximum length of rootstock with softwood grafting.

Girth of rootstock

The maximum rootstock girth (Table 2) was recorded in Fazli (8.6mm) followed by Langra (8.29 mm), Amrapali (8.09 mm), Mallika (7.9 mm) and Lucknow Safeda (7.83 mm), while, the minimum was recorded in Ramkela (7.77 mm) variety at 240 days after grafting. Maximum rootstock girth (6.96, 7.09, 7.49, 7.87, 7.93 and 8.6mm) was recorded in Fazli variety in 30, 60, 90, 120, 180 and 240 DAG, respectively as compared to other variety rootstock girth. Fazli recorded highest rootstock girth of 8.6 mm among varieties due to a greater number of leaves which caused more production of synthesized food material. These must had helped to increase girth of rootstock. It is in conformity with the observations of Nalage *et al*. (2010) in mango.

Number of leaves per scion part

The data (Table 3) on number of leaves present on scion part showed significant difference at 30, 60, 90, 120, 180 and 240 days after grafting. Among selected rootstock grafted varieties, the number of leaves per scion part was observed to be highest (23.57) in Langra followed by Fazli (22.47), Amrapali (21.27), Mallika (20.44) and Lucknow Safeda (19.41), while, the minimum (18.67) was recorded in Ramkela variety at 240 days after grafting.

Maximum number of leaves per scion part (11.37, 13.35, 16.45, 18.38, 20.62 and 23.57) were recorded at 30, 60, 90, 120, 180 and 240 DAG, respectively in Langra variety as compared to other variety number of leaves. This may be due to quicker and stronger mobilization and

Table 3 : Effect of various rootstocks on number of leaves and leaf area using Dashehari scion.

Treatment/ Rootstock	Number of leaves per scion						Leaf area (cm^2)					
	30 DAG	60 DAG	90 DAG	120 DAG	180 DAG	240 DAG	30 DAG	60 DAG	90 DAG	120 DAG	180 DAG	240 DAG
T_1 - Langra	11.37	13.35	16.45	18.38	20.62	23.57	90.08	96.24	105.25	112.52	118.3	126.17
T_2 - Lucknow Safeda	7.38	9.20	13.17	14.38	16.60	19.41	79.2	85.18	94.49	102.03	108.9	115.15
T_3 - Mallika	10.20	12.17	15.43	16.44	18.41	20.44	89.12	94.42	101.07	109.28	116.67	124.72
T_4 - Amrapali	8.19	10.18	14.64	15.45	17.66	21.27	78.71	87.22	95.45	104.47	111.84	118.07
T_5 - Fazli	9.47	11.40	15.47	17.38	19.42	22.47	95.11	105.17	115.57	121.16	124.95	128.18
T_6 - Ramkela	6.91	8.12	12.43	13.89	15.41	18.67	80.2	89.35	98.18	107.06	114.18	120.28
SEm ±	0.166	0.054	0.090	0.173	0.205	0.125	0.019	0.033	0.515	0.081	0.040	0.047
C.D. (p=0.05)	0.528	0.171	0.288	0.553	0.54	0.400	0.060	0.106	1.643	0.259	0.0129	0.150

Table 4 : Effect of various rootstocks on length and girth of scion using Dashehari as scion.

Treatment/ Rootstock	Scion length (cm)						Girth of scion(mm)					
	30 DAG	60 DAG	90 DAG	120 DAG	180 DAG	240 DAG	30 DAG	60 DAG	90 DAG	120 DAG	180 DAG	240 DAG
T_1 - Langra	15.47	20.14	22.19	23.27	24.56	24.67	4.53	4.37	4.7	4.81	5.09	5.32
T_2 - Lucknow Safeda	12.86	15.39	17.43	18.45	19.26	20.25	4.36	4.28	4.37	4.8	5.07	5.2
T_3 - Mallika	14.85	18.56	20.44	21.36	23.24	23.54	5.02	4.59	4.86	4.93	5.17	5.39
T_4 - Amrapali	12.29	14.53	15.51	16.69	18.27	18.57	4.28	4.34	4.56	4.77	5.02	5.17
T_5 - Fazli	14.31	17.58	18.54	20.38	21.54	22.53	6.54	6.85	7.05	7.14	7.41	7.66
T_6 - Ramkela	13.37	15.71	17.63	18.79	20.13	20.91	4.42	4.38	4.44	4.79	5.05	5.18
SEm ±	0.094	0.164	0.113	0.159	0.099	0.147	0.005	0.060	0.013	0.323	0.007	0.010
C.D. (p=0.05)	0.305	0.525	0.359	0.507	0.316	0.468	0.015	0.192	0.040	1.031	0.022	0.031

improved nutrient absorption leading to better plant growth and higher number of leaves per plant. Similar result was obtained in Alphonso mango, where the highest number of leaves were produced in the month of May in softwood grafting. Shinde *et al*. (2011) observed maximum number of leaves in the month of May in softwood grafting of jamun. Razzaque (2005) in his experiment, reported that higher number of leaves (34.69) was observed from June grafting of Amrapali mango cultivar.

Leaf area

The data on leaf area was recorded at 30, 60, 90, 120, 180 and 240 days after grafting were presented in Table 3. Significant differences were recorded in leaf area among different rootstocks with same Dashehari scion. The maximum leaf area was recorded in Fazli (128.18 cm2) followed by Langra (126.17 cm^2), Mallika (124.72 cm^2) Ramkela (120.28 cm^2) and Amrapali (118.07 cm^2), while, the minimum was recorded on Lucknow Safeda **(**115.15 cm^2) variety at 240 days after grafting. In Fazli variety maximum leaf area (95.11, 105.17, 115.57, 121.16, 124.95 and 128.18 cm^2) were recorded in 30, 60, 90, 120, 180 and 240 DAG, respectively as compared to other variety leaf area.

The possible reason for maximum leaf area in Fazli grafts might be due to the genetic characteristics of these varieties and increased vegetative growth may be due to the physiological process activated by the plant metabolism and growth stimulating factor. Alam *et al.* (2006), Jana (2007), Patil *et al.* (2008) and Islam and Rahim (2010) also recorded a greater number of leaves and leaf area pet graft with different varieties of mango in their studies.

Scion length

The maximum scion length was recorded in Langra (24.67 cm) followed by Mallika (23.54 cm), Fazli (22.53 cm), Ramkela (20.91 cm) and Lucknow Safeda (20.25 cm), while, the minimum was recorded in Amrapali (18.57 cm) variety at 240 days after grafting (DAG) (Table 4). Langra variety recorded maximum scion length (15.47, 20.14, 22.19, 23.27, 24.56 and 24.67 cm) were recorded in 30, 60, 90, 120, 180 and 240 DAG, respectively as compared to other variety plant height. Langra recorded scion length of grafted plant (24.67 cm) among varieties due to less time taken to first leaf emergence, thus, there is increased scion growth due to better contact of cambium layers of stock and scion along with improved

Table 5 : Effect of rootstock on number of branches and total height of plant using Dashehari scion grafted on various rootstocks.

Treatment/ Rootstock	Number of branches per plant		Total height of plant (cm)					
	180 DAG	240 DAG	30 DAG	60 DAG	90 DAG	120 DAG	180 DAG	240 DAG
T_1-Langra	2.66	3.66	38.09	50.08	55.4	58.43	61.27	63.83
T_2-Lucknow Safeda	1.66	2.66	32.18	38.63	43.4	45.36	48.45	50.67
T_3-Mallika	2.00	2.33	37.24	47.28	51.66	54.6	57.38	59.83
T_4-Amrapali	1.33	2.00	31.76	36.2	39.44	42.31	45.7	47.46
T_5-Fazli	2.33	3.00	36.51	44.29	47.38	50.55	53.34	55.8
T_6-Ramkela	1.00	1.66	33.34	39.51	44.82	46.61	50.27	52.18
S. Em ±	0.380	0.479	0.0028	0.162	0.184	0.203	0.201	0.088
C.D. (p=0.05)	N/A	N/A	0.727	0.516	0.589	0.648	0.643	0.281

physiological processes as well as more time available for growth of meristematic cells. In Amrapali variety minimum scion length as compared to other variety scion length. Amrapali recorded lowest scion length among varieties due to its dwarfing character. The results are similar to the findings of Sivudu *et al*. (2014) in mango.

Girth of scion

The maximum scion girth was recorded in Fazli (7.66 mm) followed by Mallika (5.39 mm), Langra (5.32 mm), Lucknow Safeda (5.2 mm) and Ramkela (5.18 mm), while, the minimum was recorded in Amrapali (5.17 mm) variety at 240 days after grafting (Table 4). At every date of data collection, a significant variation in increased scion girth was noticed. In Fazli variety, maximum Scion girth (6.54, 6.85, 7.05, 7.14, 7.41 and 7.66 mm) were recorded at 30, 60, 90, 120, 180 and 240 DAG, respectively as compared to other variety scion girth. These results were also similar with Nalage *et al*. (2010) and Shivaram *et al*. (2018). Fazli recorded highest scion girth among selected varieties due to a greater number of leaves are retained on grafts and scion which might cause more production of synthesized food material.

Number of branches per plant

The effect of selected rootstocks on Dashehari scion in respect of number of branches per plant was found statistically non-significant. However, the maximum number of branches per plant was recorded in Langra (3.66) followed by Fazli (3.00), Lucknow Safeda (2.66), Mallika (2.33) and Amrapali (2.00), while, the minimum was recorded in Ramkela (1.66) variety at 240 days after grafting (Table 5). In Langra variety maximum number of branches per plant (2.66 and 3.66) was recorded in 180 and 240 DAG, respectively as compared to other variety number of branches per plant. At initial days up to 160 days after grafting there was no new branches on grafted plants.

Total height of plant (cm)

The maximum plant height at 240 DAG was recorded in Langra (63.83 cm) followed by Mallika (59.83 cm), Fazli (55.8 cm) and Ramkela (52.18 cm) and Lucknow Safeda (50.67 cm) while, the minimum was recorded in Amrapali (47.46 cm) (Table 5). Plants grafted on Langra rootstock recorded maximum height of plant of 38.09, 50.08, 55.4, 58.43, 61.27 and 63.83 cm at 30, 60, 90, 120, 180 and 240 DAG, respectively as compared to other variety plant height. The maximum height of grafted plant (63.83 cm) recorded Langra rootstock was due to less time taken to first leaf emergence. Thus, there is increased scion growth due to better contact of cambium layers of stock and scion along with improved physiological processes as well as more time available for growth of meristematic cells.

Amrapali rootstock showed minimum height of plant (31.51, 36.2, 39.44, 42.31, 45.7 and 47.46 cm) at 30, 60, 90, 120, 180 and 240 DAG, respectively as compared to other variety plant height. Amrapali recorded lowest height of plant (47.1 cm) among varieties due to its dwarfing growth character. These results are also similar with the observations of Praveena *et al*. (2018) and Patel *et al*. (2010).

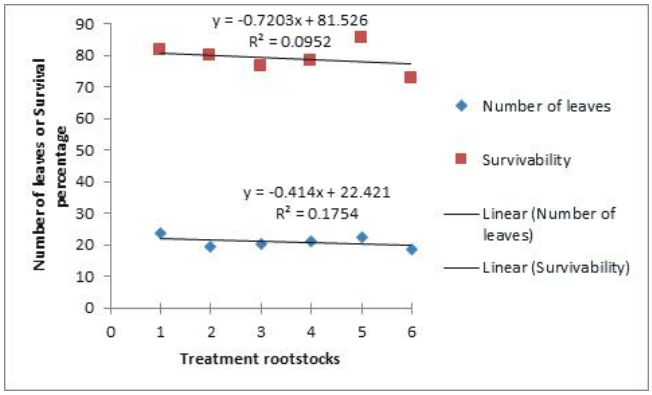

Fig. 1 : Relation between number of leaves and survival percentage.

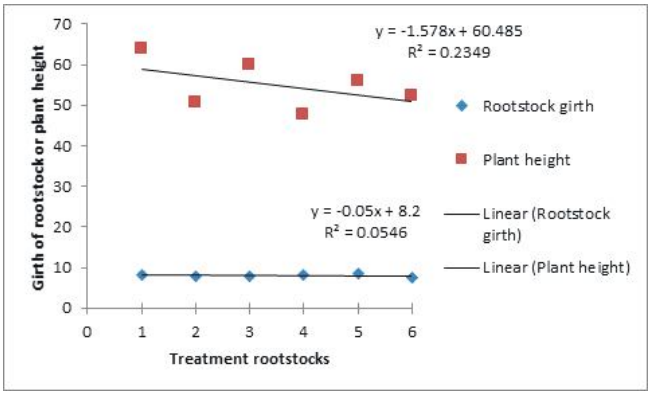

Fig. 2 : Relation between girth of rootstock and plant height.

Attempt was made to find out some relation between survival percentage and number of leaves (Fig. 1) as well as between rootstock girth and plant height (Fig. 2). Fig. 1 showed a close positive relation between number leaves and per cent survivability. Increase in leaf number also showed an increase in survivability in general. Whereas, there was no positive or negative relation found between girth of rootstock and plant height.

Conclusion

It was clear from the present study that soft wood grafting was a successful vegetative propagation method for mango. Result revealed that performance of Dashehari scion varied on different rootstock under study. Based on rootstock-scion compatibility in terms of higher survivability, better new leaf growth, more girth of scion and rootstock, it may be concluded that Dashehari scion performed best when soft wood grafted over Fazli rootstock followed by Langra under subtropical climate of Lucknow. However, soft wood grafting of Dashehari over Langra rootstock may be suggested for early leaf emergence, more number of leaves, higher plant height, better length of rootstock and scion.

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