Influence of Biomass characters of different grafted scion on the Rootstock of Mango (*Mangifera indica*L.) under Shade Net Condition of Prayagraj region.

Abstract

The experiment was conducted during the year 2019-20 & 2021-22, at Department of Horticulture, NainiAgricultural Institute, SHUATS, Prayagraj with the object to study the success and initial Biomass characters of the grafts of some important varieties of mango under net house condition. The experiment consists of ten different varieties of mango Amrapali, KishanBhog, Gulabkhas, Kesar, Totapuri, Dasheri,Malgoa, himsagar ,Nisar Pasand & Bombay Green as treatments and replicated thrice in Completely Randomized Design (CRD). The results of present investigation clearly showed that, grafts of differentmango varieties studied had a significant influence on the maximum values of biomass characters like Length of tap root (25.97 cm), No. of secondary roots (37.73) was recorded in kesar. Fresh shoot weight (19.37 g) , Dry shoot weight (g) (11.19 g), Fresh root weight (9.66 g), Dry root weight (5.04 g) was found maximum in Dasheri. Shoot root ratio (Fresh on weight basis) (2.75g) and Shoot root ratio (Dry on weight basis) (2.77 g) was maximum in Amrapali.

Keywords: Mango, Rootstock, Scion, Grafting, Monoembryonic.

Introduction

Mango grows well practically everywhere from sea level to an altitude of 1400 metres and is particularly well adapted to tropical and subtropical climates. Rainfall and excessive humidity during blooming and fruit development during the mango tree's hardiness and ability to withstand temperatures as high as 48 °C limit fruit yield. It is widely cultivated and prefers a warm, frost-free environment with well-drained soil with a pH between 5.5 and 7.5, a dry winter, and temperatures between 24 and 27 °C. The annual rainfall ranges from 400 to 3600 mm (16-142 inch). Beyond a pH of 7.5, it struggles.

Mango grafts are frequently grown on unknown seedling rootstocks, which results in variation between individual grafts. Standardizing the rootstocks for different mango cultivars in different agroclimatic zones is essential to ensure uniform development, high yield, good quality fruits, and diminutive stature of plants for high density planting. This is possible if the rootstocks are

developed asexually or with the aid of polyembryonic rootstocks, which are real types because they were developed from nucellar tissues. It is also well known that the growth, subsequent fruit-bearing behaviours, and fruit quality of the majority of fruit crops were significantly influenced by rootstocks. Therefore, it is necessary to choose the appropriate rootstocks from the available varieties locally. Since these are used as rootstock for grafting and budding, raising of rootstocks and proper use of rootstocks is equally important.

Mango is mostly vegetatively multiplied for commercial plantations by side grafting and wedge grafting, which are more efficient and inexpensive methods than other types of vegetative multiplication. As opposed to a year with side grafting, mango trees grown using wedge grafting are ready for planting in around six months. A compound horticultural tree's performance is influenced by both the rootstock and the scion (Bose et al., 1991). Mango trees are grafted trees for the most part, and they are often grown in kitchen gardens or commercial orchards. Each tree is made up of two components: the scion, which creates the tree canopy, and the rootstock, which provides the root system. These two components are equally important to the survival of a tree. Grafting is a common and preferred vegetative propagation method for mango trees **Bally (2006).** Furthermore, proper alignment of scion and rootstock cambium tissues could determine the graft success **Pina and Errea (2005).**

There are definite advantages to softwood grafting over other vegetative propagation techniques. It is efficient, affordable, rapid, and can generate grafts in as little as a year. Softwood grafting hence leads to better and more consistent orchard installations, early success, and a lower danger of passing away.

Graft healing and acclimation during the grafting procedure are essential for grafted plants to thrive. As a result, for the scion and rootstock to successfully join, callus tissue must first grow, then vascular tissues must join. The type of scion used, the materials used for the rootstock, and the current environmental circumstances all play a role in how well a graft takes and the following growth and development of the scion shoot. Hartmann et al. (2007).

Rootstocks are fundamentally always seedlings, whether they are zygotic or nucellar. Particularly in India, monoembryonic non-descriptive seedlings are often used. Monoembryonic seedlings exhibit huge variability in germination and vigour depending on where they are duplicated and the environment. Only available in dry and semi-arid regions from April to June, mango stones have a detrimental effect on the vigour and germination rates in these regions. The month of September is said to be a busy time for graft in these areas. The rootstocks grown in

September will not grow to the desired girth and size for grafting, which will decrease the success of graft take and further decrease the survivability of grafted plants. **(Kumar *et al.* 2008a).**

There are definite advantages to softwood grafting over other vegetative propagation techniques. It is efficient, affordable, rapid, and can generate grafts in as little as a year. Therefore, better and more uniform orchard installations, early success, and a lower chance of death are all outcomes of softwood grafting. The rootstock must be vigorous when being grafted; this is the key need.

MATERIALS AND METHODS

This chapter contains the details of methodology and materials used during the experimentation. The investigation was conducted during 2019-2020 and 2021-2022 at the Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture Technology and Sciences, Prayagraj.

3.3 Materials:

The Scion has been arranged from Central Institute of Subtropical Horticulture (CISH), Lucknowand the rootstock from Patel Nursery (in front of Chaka Block, Prayagraj). There will be 10 varieties of Scion (each 30 in number) and will be grafted on the polyembryony rootstock of Mango.

3.4 Selection of scion material:

The mother plant used were selected which was disease free and 6 months to 12 months old, The scion shoots of 25-30 cm length with 3 – 4 healthy buds were used for grafting. Selected scion shoots were defoliated on the mother plant about 5 – 7 days prior to detachment and at the same time, the apical growing portion of selected shoots were also beheaded which helped in forcing the dormant buds to swell.

3.5 Raising of rootstock

To raise the rootstock nursery, fully ripeddesi mango fruits/stones were collected from disease free, healthy, well managed and actively growing mango trees. One of the area's well-known model farmers provided the native rootstocks, and he managed them according to suggested cultural practises. Local types are typically favoured as rootstocks due to their disease resistance and environmental adaptation. Stones were collected, cleaned with fresh water, and treated with 10 grammes of carbendazim in 10 litres of water. In the month of August, stones were sowed in elevated beds with a 10 cm 5 cm spacing, vertically. The stones germinated in two to three weeks, and following germination, the seedlings and stones were moved to the nursery beds after the leaves had turned brown and had grown to a quarter of their original size. At the time of transplanting, the tap roots of these seedlings were pruned by retaining most of the fibrous roots. These transplanted seedlings were regularly watered and protected from the frost during winter season. Seedlings resumed growth in the end of February or beginning of March and became graftable from March onwards.

Softwood grafting technique

The top fresh growth (Bronze coloured shoots) developed on the rootstock was decapitated with sharp knife. After this, a longitudinal cut of 5 cm in length was given on the terminal trimmed shoot. The top of the rootstock appeared like the letter 'V'. The leaves below the 'V' cut were kept intact. A scion that was around the same thickness as the rootstock's severed shoot was chosen. The utilised scion was about 12 cm long. By shaving off the bark and a small amount of wood from the two opposing sides, the bottom end of the scion was transformed into a gently sloping wedge measuring about 5 cm. On the remaining two sides, care was taken to preserve the bark. A 1.5 cm wide by 45 cm long, 200 gauge thickness white translucent polythene tape was used to tightly fasten the wedge-shaped scion that had been manufactured in the manner described above. The scion on newly made graft were covered with small transparent polythene covers to avoid the desiccation of scions, by creating humidity near and above the graft union region.

After care of the graft

The polythene bags holding the grafted mango plants were kept in some shade. Regular watering of the plants was done with care made to ensure that water did not reach the graft union area. When sprouts began to emerge on the scion, the translucent polythene covers that had been placed on it after grafting were

removed. When observed, sprouts that appeared on the rootstock beneath the graft union were routinely removed. Regular prophylactic pesticide spraying was also applied to control pest attacks.

RESULTS AND DISCUSSION

The results of the investigation regarding the influence of scion varieties and rootstock on growth of mango have been presented in tables, graphically illustrated through bar-diagrams, wherever required, and discussed in the light of the findings reported by earlier researchers. The findings have been divided into the following sub-headings:

Length of tap root (cm)

The maximum length of tap root (cm) grafted plant (25.97 cm) was recorded in kesar followed by Himsagar, Nisar Pasand, Bombay Green and Dasheri. Whereas the minimum length of tap root (cm) grafted plant (19.73 cm) was found in Amrapali.

No. of secondary roots

The maximum secondary roots grafted plant (37.73) was recorded in kesar followed by Dasheri,Totapuri,Kishanbhog and Malgoa. Whereas the minimum secondary roots grafted plant (29.17) was found in amrapali **.**

Fresh shoot weight (g)

The maximum Fresh shoot weight (g) grafted plant (19.37 g) was recorded in Dasheri followed by Bombay Green, Malgoa and Gulabkhas. Whereas the minimum Fresh shoot weight (g) grafted plant (15.11 g) was found in kesar. . The similar results regarding fresh weight of shoots in sapota grafts has been reported by aonla **Choudharys *et al.*, (2016).**

Dry shoot weight (g)

The maximum dry shoot weight (g) grafted plant (11.19 g) was recorded in dasheri followed by Totapuri,Bombay Green, NisarPasand and Gulabkhas. Whereas the minimum dry shoot weight (g) grafted plant (8.36 g) was found in kesar. The similar results regarding dry weight of shoots in sapota grafts has been reported by **Choudharys *et al.*, (2016).**

Fresh root weight (g)

The maximum fresh root weight (g) grafted plant (9.66 g) was recorded in dasheri followed by Amarpali,Malgoa,NisarPasand,Bombay Green and Totapuri. Whereas the minimum fresh root weight (g) grafted plant (7.01 g) was found in kesar. The production of the most fresh shoot weight in the variety Dasheri may be attributed to the high diameter of the graft, which suggests better compatibility with the rootstock and has assisted for better movement of solutes from roots to shoots and from shoot to roots, resulting in optimum growth of the grafts and higher accumulation of carbohydrates in plant body, which may have contributed to higher shoot weight **Bobade *et al.*, (2018).**

Dry root weight (g)

The maximum dry root weight (g) grafted plant (5.04 g) was recorded in dasheri followed by Amarpali,Gulabkhas,Totapuri,Himsagar and NisarPasand. Whereas the minimum dry root weight (g) grafted plant (3.49 g) was found in kesar **.** The production of the most fresh shoot weight in the variety Dasheri may be attributed to the high diameter of the graft, which suggests better compatibility with the rootstock and has helped for better movement of solutes from roots to shoots and from shoot to roots resulting in optimum growth of the grafts and higher accumulation of carbohydrates in plant body, which may have contributed to higher shoot weight **Bobade *et al.*, (2018).**

Shoot root ratio (Fresh on weight basis)

The maximum Shoot root ratio (Fresh on weight basis) (2.75 g) was recorded in Amarpali followed by Gulabkhas, Kishanbhog, Dasheri and Bombay Green. Whereas the

minimum Shoot root ratio (Fresh on weight basis) (1.79 g) was found in NisarPasand. The vigorous vegetative development and greater adaptability of variety Amrapali to the existing environmental circumstances are indicated by the high shoot: root ratio on a fresh weight basis. Due to its ability to adapt to the semi-arid environments of Marathwada, the Amrapali variety may have produced grafts with a high shoot-to-root ratio and demonstrated promising performance in these settings. **Bobade *et al* (2018).**

Shoot root ratio (Dry on weight basis)

The maximum Shoot root ratio (dry on weight basis) (2.77 g) was recorded in Amarpali followed by Gulabkhas,Kishanbhog,Dasheriand Bombay Green. Whereas the minimum Shoot root ratio (dry on weight basis) (1.83 g) was found in NisarPasand and Himsagar

Table 1. Different Biomass characters of grafted scion on the Rootstock of Mango (*Mangifera indica* L.) under Shade Net Condition of Prayagraj region

Varieties	Varieties name	length of tap root (cm)	No. of secondary roots	Fresh shoot weight (g)	Dry shoot weight (g)	Fresh root weight (g)	Dry root weight (g)	Shoot root ratio (Fresh on weight basis)	Shoot root ratio (Dry on weight basis)
V_1	**Amarpali**	19.73	29.17	18.17	9.72	8.47	4.66	2.75	2.77
V_2	**Kishanbhog**	21.19	32.97	17.53	9.96	7.32	3.92	2.40	2.47
V_3	**Gulabkhas**	22.52	31.43	18.23	10.99	7.38	4.06	2.54	2.60
V_4	**Kesar**	25.97	37.73	15.11	8.36	7.01	3.49	1.99	2.23
V_5	**Totapuri**	22.55	35.86	16.68	9.82	8.66	4.25	1.97	2.11
V_6	**Dasheri**	24.75	33.95	19.37	11.19	9.66	5.04	2.14	2.51
V_7	**Malgoa**	23.85	32.55	18.66	9.69	8.41	4.47	2.19	2.13
V_8	**Himsagar**	25.31	26.30	16.42	10.45	8.03	4.60	1.90	1.83
V_9	**NisarPasand**	24.54	28.33	17.49	9.55	8.59	4.99	1.79	1.85
V_{10}	**Bombay Green**	24.45	30.31	18.22	10.59	8.01	4.19	2.31	2.54
	F-Test	**S**	**S**	**S**	**S**	**S**	**S**	**S**	**S**
	C.D. 0.5%	0.61	**2.14**	**1.73**	**1.49**	**0.42**	**0.20**	**0.25**	**0.38**
	S.Ed (+)	0.29	**1.02**	**0.82**	**0.71**	**0.20**	**0.09**	**0.12**	**0.18**

CONCLUSION

The current analysis indicated that, at the nursery stage, the performance of grafts of the varieties Dasheri, Malgoa, Nisar Pasand, and Amrapali was superior since these grafts required a relatively high survival percentage. These kinds had the highest shoot:root ratio and graft diameter growth metrics. Moreover, grafts of stated kinds showed noticeably improved root and biomass characteristics. The scion wood of the varieties Dasheri, Malgoa, Amrapali, and Nisar Pasand may thus be used to propagate mango plants on a large scale using wedge grafting, as these grafts have shown the greatest performance and have the highest growth parameter values.

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