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Success of Wood Apple Grafting as Influenced by Time and Rootstock

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ABSTRACT
An experiment was conducted to see the effect of time and rootstock on the success of wood apple grafting. There were 2 factors in this experiment. Factor A consisted of three grafting time, viz. 15 May, 15 June and 15 July and factor B consisted of two rootstocks, viz. bael and wood apple. The highest (35.23 cm) plant ht. was observed on 15 May grafting followed by 15 June (28.87 cm) and the lowest plant ht. recorded from 15 July (26.82 cm). The maximum no. branch (1.67) and leaves (23.33) were found on 15 May. Minimum no. (10) leaves were recorded from 15 June but minimum no. (1.00) branches were recorded on 15 July. It was observed that wood apple rootstock performed better over bael rootstock in all the parameters studied from rootstock's effect point of view. In case of combined effect it was revealed that in three grafting times wood apple rootstocks performed better over bael rootstocks in all the parameters studied except no. of branch.BARI wood apple-1 gave the highest no. of leaves (26.67) when they were grafted on wood apple rootstock on 15 May followed by 15 July x wood apple rootstock (22.67). The lowest no. leaves (6.67) produced from 15 June x bael rootstock. The highest (100%) and the lowest (10%) survivality were recorded from 15 June x wood apple rootstock and 15 July x bael rootstock, respectively.

1. Introduction

Wood apple (*Feronia limonia*) under the family rutaceae is a deciduous, slow-growing, erect tree with a few upward-reaching branches. It possesses great tolerance to drought. The scooped-out sticky pulp is eaten raw with or without sugar. It is also used in chutneys and for making Jelly and Jam. It is usually propagated by seed (Bose *et al*., 2002) [1-3]. Vegetative propagation is done in order to maintenance of genetic uniformity and preservation of identity of clone or cultivar is well recognized in horticultural crops (Raghavendra *et al*., 2011) [4-8]. BARI recently developed one wood apple variety which known as BARI Wood apple-1. It was observed that wood apple easily side grafted on both bael (*Aegle marmelos*) and wood apple in RARS nursery, Hathazari. But bael rootstocks are not easily available in private nurseries as well as their price are high.It was also observed that bael rootstock was not as healthy as wood apple rootstock[9-12]. On the otherhand, farmers/growers can obtain numerous rootstocks/seedlings from single wood apple fruit.It was important that, to find out proper time for successful grafting in wood apple. Based on the above facts, the present study was undertaken to findout suitable rootstock and proper time for successful grafting in wood apple[13-15].

2. Materials and Methods

The experiment was carried out at the nursery of RARS, BARI, Hathazari, Chittagong during 2018- 2019. Scions of BARI Wood apple-1 and rootstocks of BARI Wood apple-1 and bael were used in this study. There were 2 factors in this experiment. Factor A consisted of three grafting times, viz. 15 May, 15 June and 15 July and factor B consisted of two rootstocks, viz. bael and wood apple. So total number of treatments were 6 (six). Each treatment consisted of 10 grafts and replicated 3 times. The experiment was set under Completely Randomized Design (CRD). Acoording to the treatments, scions were collected in the morning (7-8 AM) on the day of grafting from OMT (Original Mother Tree) and grafts of BARI wood apple-1 grown in previous year. Immediate after separation of scions from source plants, they were wrapped with wet cotton cloth and carried to grafting house. New and healthy scions free from disease and pest were considered. Collected scions were dipped in 0.1 percent ridomil solution to make the scions free from fungal infections. Grafting was done according to grafting treatments.

The age of the rootstocks was one year old. The rootstocks were cut about 2.5 cm (1 inch.) at one side of upper portion with a sharp knife. Scions were also prepared by cut 2.25 cm at one side of their morphological base in order to make successful grafts. Amar Singh (1990) [3] mentioned that in side graft scion is put on the side of a stock of larger diameter of 2-3 cm. The scion is made free of all the lateral branches and growths near the point of graft. The cut made was long, slopped and wedged shaped. In this investigation, the cut length of rootstocks and scions were similar as work of Amar Singh (1990) [3]. The scions were successfully side grafted on root stocks. After grafting the grafts were kept under polyvinyl shade house at nursery. Data on plant height (cm), number of branch, number of leaf and survival (%) were recorded. Data were recorded 1.5 month after each grafting time. The data were analyzed using R statistical software. Differences among the means were compared following

Least Significance Difference (LSD) Test at 5% level of significance.

3. Results and discussion

A. Effect of grafting time

There were no significant effects of grafting time among the parameters studied except plant height and percent survival (table 1). The highest (35.23 cm) plant ht. was observed on 15 May grafting followed by 15 June (28.87 cm) and the lowest plant ht. recorded from 15 July (26.82 cm). There was no significant difference of grafting times under the parameter no. of branch and no. of leaves. The maximum number of branch (1.67) and leaves (23.33) were found on15 May. The minimum number (10) of leaves were recorded from 15 June but minimum no. (1.00) of branches were recorded on 15 July. In case of percent survivality 15 June was found superior over other grafting times. 75% survivality was recorded from this grafting time. Kadam *et al*.(2005) obtained 90.6% srvivality and they suggested June is the suitable time for quick multiplication in wood apple, which strongly supports the present findings.

Table 1: Different physio-morphological characters of wood apple grafts as influenced by Grafting time

Grafting time	Plant height (cm) (45 DAG)	No. of branch (45 DAG)	No. of leaves (45 DAG)	Survival (%) (45 DAG)
15 May	35.23 a	1.67	23.33	60 b
15 June	28.87 ab	1.17	10.00	75 a
15 July	26.82 b	1.00	15.67	50 b

Means in a column followed by uncommon letters varied significantly at 5% level of significance

B. Effect of rootstock

Two types of rootstock showed significant differences under different parameters studied except number of branch and number of leaves (table 2). From table 2 it was observed that wood apple rootstock performed better over bael rootstock in all the parameters studied. Raghavendra *et al*.(2011) obtained the maximum number (14.2) leaves using seven months old rootstocks when grafts were kept either in open or poly mist house condition. They used soft wood grafting method on wood apple rootstock. Raghavendra *et al.*'s (2011)[4] findings agreed with present study that wood apple rootstocks are suitable for wood apple grafting. Kadam *et al*. (2005) also reported that they used wood apple rootstocks for wood apple bud grafting. Amar Singh (1990) reported that success of graft depends on the union of cambial portion of one unit with that of the other so intimately the sap flows from one to the other. He also mentioned that any two plants having close botanical relationship may be used for graft, one serving as a root stock and another as scion. Grafts between two plants of different families may also succeed ocassionally. From table 2 it was revealed that performances of wood apple rootstocks were superior over bael rootstocks. The success of wood apple rootstocks was superior because scions were wood apple. Both scion and rootstock were same plant under same family, so more success were observed. Grafts within a species or genera are more common and successful. In an investigation of mango, Bose *et al*. (2019) mentioned higher percentage of grafts obtained when good quality stock plant with appropriate growing conditions were assured. He also mentioned that to assure proper growth and development of grafted plants, mulching and watering would be done as and when necessary. Rajput and Haribabu (2004) were mentioned that rootstock is a very vital component of graft. They were described some characteristics of good rootstock, such as- 1) the rootstock must exhibit a high degree of congeniality with the scion variety and give maximum economic life to the tree, 2) it should be well adaptable to the agro-climatic conditions of the proposed area and 3) the stock should have other desirable qualities like salt tolerance, drought resistance, frost endurance etc. In present investigation wood apple rootstock was performed better under all the parameters studied, it was due to both rootstock and scion were same plant. So, both rootstock and scion were more congenial than bael rootstock, which support the reports of Rajput and Haribabu (2004).

Table. 2. Different physio-morphological characters of wood apple grafts as influenced by rootstocks

Type of Rootstock	Plant height (cm) (45 DAG)	No. of branch (45DAG)	No. of leaves (45DAG)	Survival (%) (45 DAG)
Bael	25.42 b	1.11	11.78	40.00 b
Wood apple	35.19 a	1.44	20.89	83.33 a

Means in a column followed by uncommon letters varied significantly at 5% level of significance

C. Integrated effects of grafting time and rootstock

Combined effects of grafting time and rootstock were found significant in all the parameters studied (Table 3). From table 3 it was revealed that in three grafting times wood apple rootstocks performed better over bael rootstocks in all the parameters studied except number of branches. The highest plant (43.90 cm) was recorded from wood apple rootstock when they were grafted on 15 May. The lowest plant (24.03 cm) was found when bael rootstock was used in 15 July.BARI wood apple-1 gave the highest number of leaves (26.67) when they were grafted on wood apple rootstock on 15 May followed by wood apple rootstock (22.67) grafted on 15 July. The lowest number leaves (6.67) produced from 15 June grafted onbael rootstock. Fig. 1 was showed the wood apple grafts, when grafting done in May, June and July (from right to left). Behind the tag of each month the root stocks of right row's grafts were bael and left row's grafts were wood apple. From this figure it was revealed that when bael was used as rootstock the growth of rootstock was more than scion and when wood apple was used as rootstock the growth of scion was higher than rootstock. It was also revealed that wood apple scion when grafted on wood apple rootstock in May the grafts were healthy, vigourous, compatible and having profound growth. Kadam *et al*. (2005) obtained the maximun (17.40) and minimum(6.46) number leaves 60 days after bud grafting.

The highest number leaves (26.67) produced in this study was more than that of Kadam *et al*.(2005), it may be due to age of rootstock. Kadam *et al*.(2005) used 3 months old rootstock but rootstocks used in this study were 1year old. The lowest number leaves were almost same in both findings (6.67 and 6.46, respectively). Raghavendra *et al.* (2011) reported that nine months old wood apple rootstock produced the maximum leaves (14.1) when the grafts were kept in open condition. But eight months old wood apple rootstock producedthe maximum leaves (16.7) when the grafts were kept in mist house condition. The highest (100%) and the lowest (10%) survivality were recorded from wood apple and bael rootstocks when they were grafted on 15 June and 15 July, respectively. Kadam *et al*.(2005) observed the highest (90.6%) survivality using wood apple rootstock. Raghavendra *et al.* (2011) found the highest survivality (95% and 99.2 %, respectively) from 8 months old wood apple rootstock when the grafts were kept in open and mist house condition, respectively. These findings support that cent percent survivality could be achieved when wood apple scion grafted on wood apple rootstock.

Table 3. Different physio-morphological characters of wood apple grafts as influenced by grafting time and root stock

Grafting time	Type of rootstock	Plant height (cm) (45 DAG)	No. of branch (45 DAG)	No. of leaves (45 DAG)	Survival (%) (45 DAG)
15 May	Bael	26.56 b	1.00 b	20.00 ab	60 b
	Wood apple	43.90 a	2.33 a	26.67 a	60 b
15 June	Bael	25.67 b	1.33 ab	6.67 b	50 b
	Wood apple	32.07 b	1.00 b	13.33 ab	100 a
15 July	Bael	24.03 b	1.00 b	8.67 ab	10 c
	Wood apple	29.60 b	1.00 b	22.67 ab	90 a

Means in a column followed by uncommon letters varied significantly at 5% level of significance

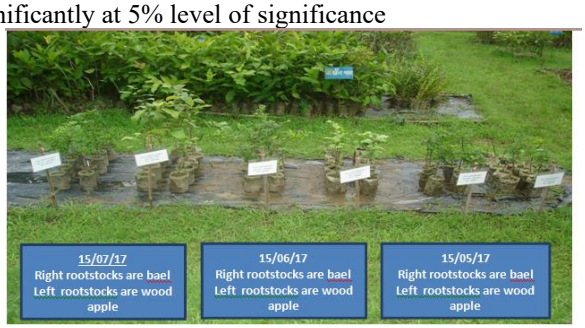

Fig. 1. Scions of BARI Wood apple-1 were grafted on wood apple (left row) and bael (right row) root stocks in May, June and July, respectively.

4. Conclusions

From the above findings it was concluded that wood apple could be grafted on wood apple rootstock and June was the suitable time for grafting.

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