

Standardization of propagation methods and timing in Walnut (*Juglans regia*) under climatic conditions of district Reasi, Jammu Province, J & K, India

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ABSTRACT

On farm trails were conducted on propagation methods under polyhouse and open field conditions during the year 2021 and 2022 at KVK Reasi SKUAST- Jammu. Two methods viz wedge and tongue grafting at different levels of timings viz, 1st, 2nd week of February in 2X2 factorial CRBD under polyhouse and repeated at 3rd week of Feb. and 1st week of march in 2x 2 factorial RCBD under open field conditions with three replications to standardize method and feasible timing for walnut propagation in District Reasi (J&K). Wedge grafting at 2nd week of February at polyhouse conditions revealed maximum scion take (64.24%) and scion sprouting (54.77) respectively, whereas tongue grafting recorded at par (59.63) scion take and (52.36%) scion sprouting in similar environment comparatively higher than field conditions. Whereas interaction between methods x timings revealed wedge grafting in 2nd week of February showed maximum scion take (64.99%) and scion sprouting (57.20%) significantly higher than 1st week of February (63.49%) scion take and (52.33%) scion sprouting under Polyhouse conditions. Graft success under open field conditions at interaction of wedge method x 3rd week of February showed significantly higher scion take (60.87) and scion sprouting (50.12) higher whereas tongue grafting at 1st week of march recorded minimum scion take (53.05%) and scion sprouting (44.25%). Vegetative growth viz. stem diameter (mm), No. of leaves, leaflets size (cm²), plant height (cm), were significantly influenced in walnut grafts. The results indicate that walnut grafting could be economically significant vegetative propagation method in Reasi conditions. Wedge Grafting performed in 2nd week of February under polyhouse was observed most suitable procedure to propagate walnuts at mass scale under climatic conditions of District

Key words: Grafting, Method, Time, Walnut and scion take.

Introduction

The Persian walnut (*Juglans regia* L.) known as English walnut is the most valuable commercial species in its genus belonging to family Juglandaceae,

origin in eastern Europe, Asia minor, extending from Turkey, Iran and western China to eastward to the Himalayan regions (Lessile and McGranahan, 1998). All juglans species are monoecious, with catkins being borne laterally on one year old wood and

pistillate flowers borne terminally on current seasons wood. Walnut is rich source of fat (64%) in which 49 per cent is poly unsaturated (PUFA) a healthy fat (Polito, 1998). In India, it is grown in Jammu and Kashmir, Uttar Pradesh and Himachal Pradesh. Jammu Kashmir is principal walnut growing state having monopoly in the production of export quality nuts. The state of Jammu and Kashmir occupies an important position, as far as growing of walnuts is concerned, producing about 85 per cent of total production of walnuts of the country, and has monopoly in production of export quality walnuts. Jammu & Kashmir has an area of about 93641 Hectares with a production of 1, 65024 MT, giving an average productivity of 1.89 metric tones/ha. Among which District Reasi UT J&K has an area of 1770 Ha with 3872 MT production (Anonymous, 2020). The existing plantations in the world are generally of seedling origin and notably variable in production and nut quality (Avanzato, 2001; Vahdati, 2006). Since entire walnut population of J&K is seedling origin, there is non availability of planting material of known pedigree. Due to higher market demand for quality nuts and increased productivity; satisfactory methods of vegetative production in Persian walnut are needed in order to supply quality planting material. Secondly walnut is hard to propagate due to accumulation of the phenolic compound like 4 hydroxynaphthoquinone (Juglone) is more harmful for growth of walnut callus formation (Solar *et al.*, 2001; Ozkan *et al.*, 2001). Temperature and humidity have major effects on the process of walnut graft union. Specially changing in temperature among the uniting period has direct effect on callus development and successful grafting. Best temperature for walnut grafting is 27 °C (Vahdati, 2006). To avoid low temperature in winter the objective of conducting grafting trials under subtropical temperature in District Reasi conditions was to meet the temperature for callus formation. Due to these facts availability of quality planting material to the farmers is not adequate as per the demand. The study with the objective to develop quality planting material of known pedigree using different method of grafting and timings as a procedure for vegetative propagation secondly to demonstrate quality planting material production for local farmers in order to develop regular walnut orchards under district Reasi climatic conditions.

Materials and Methods

The experiment was carried out under poly house and in open field conditions with method of grafting viz. wedge and tongue but with different timing, viz. first week of February, 2nd week of February under poly house and 3rd week of February and 1st week of March, in open field conditions (Tables 1 and 2). Experiment under different environmental conditions was carried out at the Campus of KVK Reasi SKUAST- Jammu. The experimental site is located at 33.08°N 74.83°E with average elevation of 466 meters (1,529 feet). Walnut seeds were sown in black polythene bags (45.72×22.86 cm) containing mixture of soil, FYM and sand (2: 1: 1). One year old seedling was raised from thick shelled nuts were used as rootstock in on farm trial. The seedling rootstock of 1-1.5cm thickness was utilized for grafting purpose. The scion material was taken from identified walnut trees. The bud sticks used for grafting were one year old terminal shoots. The scions were collected from mother trees during dormancy and they were stored in a refrigerator until the time of grafting. The scion was 10-15 cm long with 3-4 buds. The basal end was cut in a long gently sloping wedge of 5 cm long, and then inserted in the split of stock, wrapped with polyethylene strips. The polyhouse used under experiment was made of simple iron structure covered with white polythene. To provide the suitable relative humidity for the success of walnut grafts, water was sprayed once or two times a day. In open field conditions, natural environment prevailed. The experiment was laid in factorial CRBD under polyhouse and 2x 2 factorial RCBD in open field conditions.

Results and Discussion

The data on the graft-take success in walnut under polyhouse and open field conditions are given in Tables 1, 2, 3 and 4. Results revealed that scion take and sprouting success percentage in walnut was significantly affected by grafting methods and grafting dates. Wedge grafting performed on 2nd week of February recorded maximum scion take (64.99%) and scion sprouting (57.20%), followed by (62.04%) and (55.12) with tongue method of grafting performed at 2nd week of February under poly house conditions. While as grafting in open field conditions showed success which was statistically non

significant. The success percentage obtained on wedge grafting performed at 3rd week of February under open field conditions recorded scion take (60.87%) and scion sprouting (50.12%) was statistically significant. However minimum scion take (49.89%) and scion sprouting (43.67%) was recorded in tongue grafting performed at 1st week of March under open field conditions Table 2. Wedge grafting x 2nd week of February interaction recorded higher graft scion sprouting percentage might be due to fact that favourable temperature and relative humidity favored the proper lining of cambium cells leads establishment the continuity of vascular tissues led to graft success. The results are in conformity with Duman and Serdar (2006) who reported that 55 per cent scion sprouting was observed in chestnut when grafting was performed under controlled conditions. Higher percentage of scion sprouting was observed in Wedge grafting compared to tongue grafting when performed during February, the results are in agreement with Pathak and Srivastava (1975), who reported that wedge grafting as superior method in order to achieve maximum grafting success. However Rezaee and Vahdati (2008) have reported that time

of grafting affects grafting success percentage. Whereas Gandev (2009) reported that wedge grafting in walnut recorded maximum graft success percentage performed during last week of January under poly house conditions and lowest during 4th week of February under open field conditions. Balata *et al.* (1996) who reported that the change of temperature and relative moisture especially during and after grafting directly affects the development of a good graft union in walnut. The comparatively lower percentage of success in grafting in comparison to the March grafting might be due to the fact that in February tissue attains active growth and loses their tolerance to injury. These results are in agreement with Rongting and Pinghai (1993) who reported that walnut callus quality and formation plays important role in grafting success. Lowest scion sprouting 44.16 per cent was recorded in tongue grafting performed at 1st week of March Table 2. This could be due to improper lining up of cambial layers of rootstock and scion, role of critical requirement of temperature and relative humidity for successful scion sprouting. The results in agreement with Millikan (1984) who have found optimum temperature as 27 °C (± 3.5 °C) in walnut for

Table 1. Grafting of walnut under polyhouse conditions

Parameters Grafting Methods	Scion take (%)			Scion Sprouting (%)			Stem diameter (mm)		
	Grafting Time		Mean	Grafting Time		Mean	Grafting Time		Mean
	T1	T2		T1	T2		T1	T2	
Wedge	63.49	64.99	64.24	52.33	57.20	54.77	3.69	3.49	3.59
Tongue	57.22	62.04	59.63	49.6	55.12	52.36	3.36	3.47	3.42
Mean	60.36	63.52		50.97	56.16		3.53	3.48	
CD (p<0.05)	Method (M) = 1.96 Time (T) = 2.40 (MxT) = 4.32			Method (M) = 1.13 Time (T) = 3.19 (MxT) = 4.81			Method (M) = 0.07 Time (T) = 0.02 (MxT) = 0.10		

T1= 1st week of February, T2= 2nd week of February

Table 2. Growth of walnut grafts under polyhouse conditions

Parameters Grafting Methods	No. of leaves			Leaflet size (cm ²)			Overall height (cm)		
	Grafting Time		Mean	Grafting Time		Mean	Grafting Time		Mean
	T1	T2		T1	T2		T1	T2	
Wedge	3.91	4.33	4.12	38.7	39.45	39.08	17.16	18.2	17.68
Tongue	3.90	4.26	4.08	37.07	37.71	37.39	17.14	17.2	17.17
Mean	3.90	4.30		37.89	38.58		17.15	17.70	
CD (p<0.05)	Method (M) = 0.02 Time (T) = 0.29 Method * Time (M*T) = 0.55			Method (M) = 1.02 Time (T) = 0.71 Method * Time (M*T) = 1.79			Method (M) = 0.40 Time (T) = 0.51 Method*Time (M*T) = 1.01		

T1= First week of February, T2= Second week of February

Table 3. Grafting in Walnut under open field conditions

Parameters	Scion take (%)			Scion Sprouting (%)			Stem diameter (mm)		
	Grafting Time		Mean	Grafting Time		Mean	Grafting Time		Mean
	T1	T2		T1	T2		T1	T2	
Wedge	60.87	56.43	58.65	50.12	45.10	47.61	3.12	2.81	2.97
Tongue	56.21	49.89	53.05	44.16	43.67	44.25	2.92	2.79	2.86
Mean	58.54	53.16		47.14	44.38		3.02	2.80	
CD (p<0.05)	Method (M) = 1.53 Time (T) = 2.01 Method x Time (MxT) = 3.79			Method (M) = 0.41 Time (T) = 2.90 Methodx Time (MxT) = 3.97			Method (M) = 0.09 Time (T) = 0.15 Methodx Time (MxT) = 0.31		

T1= 3rd week of February, T2=1st week of March

Table 4. Growth of walnut grafts under open field conditions .

Parameters	No. of leaves			Leaflet size (cm ²)			Overall height (cm)		
	Grafting Time		Mean	Grafting Time		Mean	Grafting Time		Mean
	T1	T2		T1	T2		T1	T2	
Wedge	3.93	2.86	3.40	38.10	33.95	36.03	16.25	15.50	15.88
Tongue	3.63	2.48	3.06	36.61	33.10	34.86	16.21	16.10	16.16
Mean	3.78	2.67		37.36	33.53		16.23	15.80	
CD (p<0.05)	Method (M) = 0.27 Time (T) = 0.69 Method*Time (M*T) = 1.02			Method (M) = 1.32 Time (T) = 3.11 Method*Time (M*T) = 4.75			Method (M) = 0.20 Time (T) = 0.38 Method*Time (M*T) = 0.67		

callus formation. Karadeniz (2005) reported that grafttake is affected by relative moisture and temperature. The studies of Gandev and Dzhuvinov (2006) also supports the fact that walnut grafting is successful in controlled conditions than in open field conditions. The data (Table 1) further reveals that interaction between wedge method x 2nd week of February (Time) have influenced Stem diameter (3.59 mm) of walnut grafts , No. of leaves (4.12), Leaflet size (39.08 cm²) and Overall height (17.68cm) recorded under polyhouse conditions statistically significant when compared with growth of walnut grafts (Table 2) in open field conditions. This might be due fact that optimum temperature and relative humidity under reasi conditions. The results are in agreement with (Zaen *et al.*, 2011) who Reported that pistachio trees grafted by cleft or side grafting methods in January gave higher significant number of shoots than from the trees which were granted by the same method in February date in both studied seasons . Suk-In *et al.*, 2006. Vegetative growth of the walnut grafts was also influenced significantly under polyhouse conditions comparatively vigorous to open conditions.

Conclusion

The wedge grafting performed on second week of February under polyhouse conditions gave highest scion sprouting percentage, however growth was also seen in tongue grafting and more than 52 percent plants attain a saleable size in a year. The wedge method of grafting in second of February is recommended for commercial multiplication of nursery plants of walnut in a year under protective conditions.

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