RESPONSE OF VARIOUS INDIGENOUS WALNUT GENOTYPES TO GRAFT TAKE SUCCESS

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ABSTRACT

A field experiment was conducted at Agricultural Research Institute, Mingora, Swat in 2007 to study the response of various indigenous walnut genotypes to graft take success. Eighteen indigenous walnut genotypes along with two exotic varieties 'Serr' and 'Payne' were tongue grafted on one year old local rootstock 'Swat Local' using a randomized complete block (RCB) design. Maximum graft take success was noted in genotype Ch-22 (75%) closely followed by Sw-8 (74%) while minimum (40%) in genotype Ch-7. Genotype Ch-20 attained maximum (192.4cm) plant height, stem diameter (25.9mm) and number of leaves per plant (43) The least plant height (56.6cm) was recorded in genotype Sw-46 while less average number of leaves per plant (15) by genotype Sw-14 during one growing season. Excluding a few genotypes, generally graft take success was above 60%. It was however, highly impressive in genotypes Ch-22 and Sw-8. This suggests higher degree of compatibility of these two genotypes with the tested walnut rootstock (Swat local) used in the region.

Key Words: ***Genotypes, Grafting, Indigenous, Juglans regia L., Local rootstock***

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INTRODUCTION

Walnut belongs to the family Juglandaceae and genus *Juglans*. The family consists of about 60 species, 21 of which are placed in the genus *Juglans*. However, the most important among them are *Juglans regia* L., and *Juglans nigra* L. (Manning, 1978) that are famous for their delicious kernels and valuable wood. Walnut tree is medium to large with spreading crown. The leaf is compound and consists of 7-11 leaflets. It is heterogamous, either protoandrous (male flowers mature first) or protogynous (female flowers mature first) depending on cultivars. This dichogamy encourages cross-pollination and thus production mainly depends on wind pollination and bloom overlap (Pua and Davey, 2007). Nuts are borne singly or in clusters and a green, fleshy husk surrounds it, which splits irregularly at maturity. Walnut growing is extremely sensitive to soil conditions and should only be planted on the most suitable frost free, fertile, well drained and deeply rootable sites (Kerr, 1993). The wood of walnut is considered as one of the most valuable woods in the world for high-grade furniture and joinery (Voulgaridis and Vassiliou, 2005). Walnuts consist of mostly omega-3 and omega-6 polyunsaturated fatty acids, which are essential dietary fatty acids and helps in the prevention of coronary heart disease (Piccirillo *et al*., 2005).

In Pakistan, generally walnuts are propagated through seed that come into bearing after 8-10 years and optimum yield is not expected until the plant reaches the age of 12-15 years. In contrast, the grafted plants come into bearing within a period of 3-5 years and reaches optimum production after 6-8 years. However, the main problem in the region is the non-availability of grafted plants, as walnut is very difficult to propagate asexually. Not all scion varieties show similar response to graft take success. Previous studies in other regions of the world revealed that genotypes/varieties showed differential response to graft take success (Ferhatoglu, 1997; Erdogan, 2005; and Stanisavljevic *et al*., 1997). Therefore the present study was conducted with the aim to identify compatible genotypes with the local rootstock that show high graft take success and also to produce enough true to type plants of desirable indigenous genotypes for conservation purposes.

MATERIALS AND METHODS

Field study was carried out at Agricultural Research Institute, Mingora, Swat during 2007. Graft-wood of

18 selected indigenous genotypes along with two exotic varieties (Serr and Payne) was collected in the month of March and grafted on one year old walnut rootstocks (Swat local) in the open field using tongue grafting as a method of propagation. Achim and Buto (2001) while comparing various methods of walnut propagation reported higher graft take success through tongue grafting. There were 20 treatments and the experiment was laid out in a randomized complete block (RCB) design with three replications. Data were collected on percent graft take success, average plant height, average stem diameter, average number of leaves plant^{-1}, average leaf length and average leaf width. Data were collected for the period of one year and analysed statistically using MSTATC package (Russell, 1989). Means were compared using least significant difference (LSD) test.

RESULTS AND DISCUSSION

Graft Takes Success (%)

Various walnut genotypes showed significantly different responses to percent graft take success (Table I). The highest graft take success (75%) was recorded in the genotypes Ch-22 and Sw-8 (74%) while the lowest (40%) was noted for the genotype Ch-7. Graft take success is highly affected by scion genotypes. Stanisavljecic *et al.* (1997) studied the effect of various scion varieties on grafting and found differential response of various varieties to graft take success. In our experiment, excluding a few genotypes, generally the graft take success was above 60%. It was however, highly impressive (75%) in genotypes Ch-22 and Sw-8. This suggests higher degree of compatibility of these two genotypes with the tested walnut rootstock (Swat Local) used in the region.

Plant Height (cm)

Plant height was significantly affected by the walnut genotypes (Table I). Genotype Ch-20 showed maximum plant height (192.4cm) followed by Ch-14 (165.2cm). The least plant height (56.6cm) was recorded in genotype Sw-46. There occurred a relationship between plant height and leaf length and width; plants with greater leaf length and width were taller (Table II). Genotype Ch-20 had the maximum leaf length and width, which consequently resulted in maximum plant height and vice versa in Sw-46. On the other hand, a positive correlation was observed between plant height and stem diameter ($r = 0.842$) and plant height and number of leaves plant^{-1} ($r = 0.842$) (Fig. 1 and 2).

Stem Diameter (mm)

Genotypes had a significant effect on average stem diameter of the grafted plants (Table I). It was observed that maximum stem diameter (25.9mm) was noted in the genotype Ch-20 and Ch-14 (24.0 mm), whereas minimum stem diameter (13.5mm) was noted for the genotype Sw-14. The maximum diameter might be due to the maximum growth attained by the same plants during the active growth period.

Average Number of Leaves

Number of leaves per plant of various walnut genotypes were also significantly affected (Table II). More leaves (43) were produced by the plants of Ch-20, while less (15) by genotype Sw-14. Our results demonstrate that plants having greater height during the active growing season showed more leaves per plant (Table-I).

Average Leaf Length (cm)

Generally the leaf length ranged between 37-48 cm. However, one genotype (Dr-67) had the minimum leaf length (32.90cm). On the other hand, Ch-20 and Sw-110 had extra large leaves (50-51cm). Since the genotypes had been grafted on one common rootstock (Swat Local) under the same climatic conditions (Mingora, Swat), it is presumed that the two extremes in leaf length could be due to extreme genotypic variation.

Average Leaf Width (cm)

Leaf width was also significantly affected by different genotypes (Table II). Genotype Ch-20 (35.1cm) and Ch-7 (31.5cm) showed the maximum leaf width while minimum leaf width (21.7cm) was noted in genotype Sw-46. This may be due to the different genetic make-up of the genotypes.

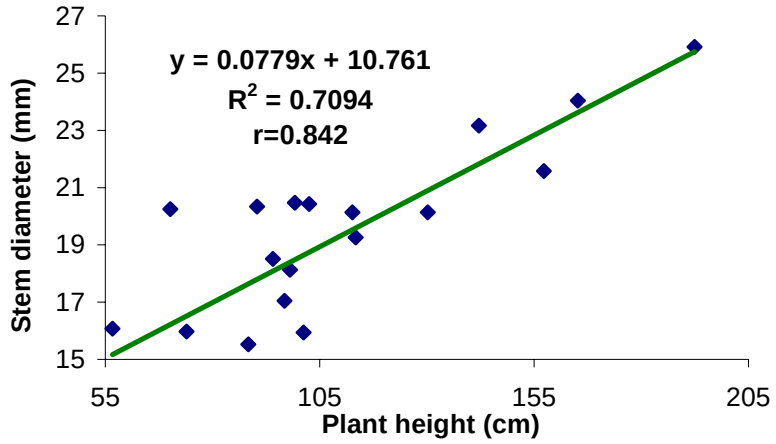

Fig. 1. ***Stem diameter (mm) as affected by plant height***

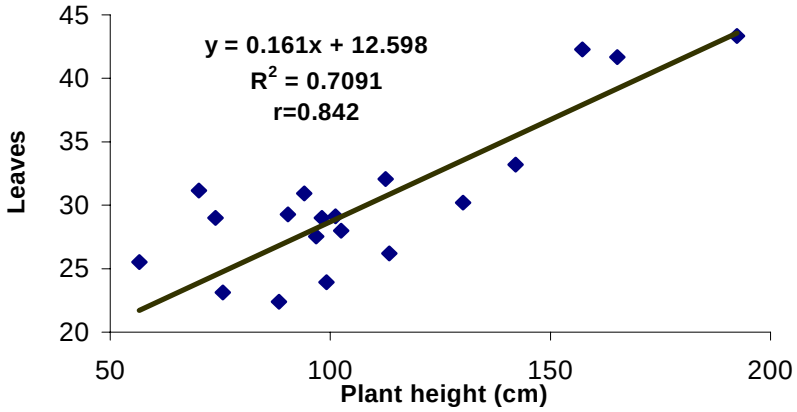

Fig. 2. ***Number of leaves as affected by plant height***

Table I. ***Percent graft take success, plant height and stem diameter as affected by different walnut genotypes***

Genotype	**% Graft take success**	**Plant height (cm)**	Stem diameter **(mm)**
Ch-1ST	61 C-F	94.1 D-H	18.5 C-F
Ch-6	55 D-G	130.2 BD	20.1 B-E
Ch-7	40 I	113.4 C-E	19.3 B-E
Ch-14	46 G-I	165.2 AB	24.0 AB
Ch-20	65 A-E	192.4 A	25.9 A
Ch-22	75 A	99.2 D-G	20.5 B-E
Dr-37	62 C-F	75.6 E-H	13.7 F
Dr-45	68 A-C	96.8 D-G	17.1 D-F
Dr-61	67 A-D	142.1 BC	23.2 A-C
Dr-62	63 B-F	73.9 F-H	15.9 EF
Dr-66	66 A-D	88.3 E-H	15.5 EF
Dr-67	43 HI	101.2 D-G	15.9 EF
Sw-8	74 AB	157.3 AB	21.6 A-D
Sw-14	54 E-H	56.9 H	13.5 F
Sw-44	66 A-D	112.6 C-F	20.1 B-E
Sw-46	47 G-I	56.6 H	16.1 EF
Sw-58	68 A-C	102.5 D-G	20.4 B-E
Sw-110	53 F-H	70.1 GH	20.3 B-E
*Serr	49 G-I	98.1 D-G	18.1 C-F
*Payne	71 A-C	90.4 E-H	20.3 B-E
LSD Value	*11.8*	*38.9*	*5.3*

Means sharing the same letters are not significantly different at 1% probability level.
* Exotic varieties

Table II. ***Average no. of leaves, leaf length and leaf width as affected by different walnut genotypes***

Genotype	**Average no. of Leaves**	**Average leaf length (cm)**	**Average leaf width (cm)**
Ch-1ST	31 C-E	41.5 C-F	28.5 B-D
Ch-6	30 C-E	45.8 A-D	28.9 B-D
Ch-7	26 C-E	45.1 A-E	31.5 AB
Ch-14	42 AB	48.8 AB	27.3 B-D
Ch-20	43 A	51.1 A	35.1 A
Ch-22	24 DE	47.7 A-C	31.4 AB
Dr-37	23 D-F	37.2 FG	28.7 AB
Dr-45	27 C-E	44.6 A-E	26.4 B-E
Dr-61	33 BC	48.8 A-C	29.9 A-C
Dr-62	29 C-E	37.8 E-G	24.4 C-E
Dr-66	22 EF	37.8 E-G	24.7 C-E
Dr-67	29 C-E	32.9 G	26.4 B-E
Sw-8	42 A	39.9 D-G	24.1 DE
Sw-14	15 F	39.4 D-G	25.3 C-E
Sw-44	32 CD	38.3 E-G	25.5 C-E
Sw-46	25 C-E	37.0 FG	21.7 E
Sw-58	28 C-E	46.5 A-D	27.6 B-D
Sw-110	31 C-E	50.2 A	27.3 B-D
Serr	29 C-E	45.7 A-D	26.1 B-E
Payne	29 C-E	42.4 B-F	28.3 B-D
LSD Value	*8.9*	*7.3*	*5.6*

Means sharing the same letters are not significantly different at 1% probability level.

CONCLUSION

The graft take success plays a key role in plant growth and development and dissimination of superior scion genotypes. In our experiment, excluding a few genotypes, generally the graft take success was above 60%. It was however, highly impressive in genotypes Ch-22 (75%) and Sw-8 (74%). This suggests higher degree of compatibility of these two genotypes with the tested walnut rootstock (Swat local) used in the region.

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