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The effect of different mediums and cuttings on growth and rooting of pomegranate cuttings

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Abstract

In order to evaluate the effects of kind of medium and kind of pomegranate cuttings (Malas- Torshe Savah) on rooting ability and growth of cuttings an experiment was done in a green house in research field of Islamic Azad University, Saveh on 2010. Main plots consisted of two medium cultures, (sand + peat and sand) and subplots consisted of three kinds of pomegranate cuttings (one bud, three buds, more than three buds). Cuttings were dipped in NAA solution with 4000 ppm concentration for 5 seconds and planted in different medium, bottom heat system (electric oven) were used to maintain temperature between 23-27 °C in the bottom of pots. The cuttings were harvested after 3 months and relevant data were recorded. The results showed that the effect of medium culture on length of roots, number of leaves and number of branches were significant ($P < 0.05$). Interaction of medium culture and kind of cuttings was only significant for root length. Comparison of rooting meanings showed that the effect of medium culture was not significant on any of the parameters. Comparison of means showed that the effects of kinds of cutting were significant on all studied parameters ($P<0.05$). Cuttings with more than three buds had highest number of leaves, numbers of branches and number of buds, but the highest lengths of roots were observed on cuttings with three buds. Comparison of means also showed that the interaction of medium culture and kind of cuttings had significant effect on number of leaves, number of branches, and number of buds. Medium of sand × more than three buds of cuttings had the highest rooting potential; however, highest length of roots were observed on sand + peat medium × three bud cuttings.

Keywords: Auxine; medium; one bud cuttings; peat; pomegranate

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Introduction

Pomegranate (*Punica granatum* L.) is a worthy crop native to subtropical regions. It has been spread to other countries from Iran, its main producer and exporter in the world. Some factors affect rooting of Pomegranate cuttings including physiological conditions of parent plant, cutting type, preparation time, medium type and rooting hormones (Polat et al., 2009). Suitable medium for cutting establishment should have enough moisture and good aeration (Hortman et

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al, 2000). The sand used for rooting consists of particles 2 mm in diameter formed from silicate compounds but has no nutrient and pH is neutral. Peat is organic matter with acidic reaction and has formed from semi decayed marsh plants and can reserve water ten up to times its volume. Melgarejo et al (1998) suggests that woody cuttings of pomegranate be prepared in winter and after one year in greenhouse transplanted to farm before spring. Best conditions for cutting preservation is 25 degree centigrade and 95-100% relative humidity (Mohseni, 2004). Twenty centimeter long cutting with nodes are suitable (Munoz, 1992). Sheet (2004) suggests that for successful rooting, 15-20 centimeters long woody cuttings with pencil diameter must be prepared in February or March and placed with one node out of soil. Hambrick et al. (1991) declare preparation time is important for rooting and late winter (February) is more suitable than early October. Shirzadi (2007) states soft wood cuttings from pomegranate trees var. Jahrom and IBA hormone application in 1500 ppm caused highest rooting percent and growth of nodes. Moradnezhad (2002) declares the highest rooting percentage is achieved with Pomegranate woody cutting, 4000 ppm auxin application and planting in sand. These 15-20 mm diameter cuttings are prepared in February. Mitra et al (1991) states woody cuttings of olive have rooted in two months by application of sand and peat medium and bottom heat (20-25°C). Albouyeh (2007) for citrus cuttings recommends only peat or mixture of peat, perlite and cocopeat with 2:2:1 ratio for plant height and leaf number increasing. Rooting percentage in pomegranate cuttings at different varieties is different (Sarjo et al, 2008). Auxin application improves rooting and increases rooting amount. Owais (2010) states application of rooting hormones can increase rooting percentage of the order of 49-73% in pomegranate cuttings. Melgarejo et al. (2008) showed application of auxin can increase number and rooting percentage as much as three times.

Materials and Methods

In order to evaluate the effects of medium and cutting types on rooting performance an experiment was carried out in the form of split plots test (complete randomized blocks) in 3 replicates. Main plots A (medium types) consist of A1 sand medium, A2 sand + peat (1:1) and subplots B (cutting types) consist of B1 single bud cuttings B2 three bud cuttings B3 more than three bud cuttings. Sand particles 0.2 mm in diameter were mixed with peat and placed in some boxes with 50×30×30 cm^3. Cuttings were dipped in Naphtalen Acetic Acid (4000 ppm) for 5 seconds and planted in different medium in January 2010. Five cuttings in every replication and bottom heat system (electric oven) were used to maintain temperature at 23-27°C in the bottom of pots. The cuttings were sprayed with

Table 1
The effects of medium and cutting types on rooting performance in Pomegranate var. Malas Torsh Saveh (Data Analaysis)

Source of Variations	Degree of Freedom	Average Data			
		root length	raised bud number	shoot number	leaf number
repeat	2	0.07^{ns}	0.30^{ns}	0.65^{ns}	103.32^{ns}
medium	1	214.76^{*}	0.41^{ns}	0.19^{ns}	0.09^{ns}
cutting	2	314.78^{*}	2.25^{ns}	4.33^{*}	410.07^{*}
medium × cutting	2	420.85^{*}	0.17^{ns}	0.00^{ns}	57.47^{ns}
error of main plots	2	11.28	1.29	2.34	289.24
error of subplots	2	27.65	0.88	1.12	111.04
cv%	-	15.68	22.11	14.76	23.78

ns = non significant $p<0.05$ = *

water for 2 minutes every day. After 3 months, the cuttings were harvested and the relevant data were recorded. These included leaf number, root number, root length, raised buds number, cutting diameter, and cutting length. SAS software was used for data analysis and Duncan test for comparison of means and Microsoft Excel for graph drawing were used.

Results

Leaf number

Results showed the effect of cutting type on leaf number was significant ($\rho < 0.05$). However, the effects of medium and interaction between cutting type and medium type on leaf number were not significant (Tables 1 and 2). On the other hand, cutting type had significantly affected leaf number (Table 3). The highest and lowest number of leaves was observed in multiple bud (19.00), and single bud cuttings (1.67) respectively. Leaf number in three bud cuttings was middling (8.77) and interaction between medium type and cutting type was not significant ($\rho < 0.05$, Table 4).

Shoot number

Effect of cutting type on shoot number was significant ($\rho < 0.05$), but medium effect, cutting type × medium type and effect of medium type on shoot number were not significant (Tables 1 and 2). Moreover, effect of cutting type on shoot number and interaction between medium type and cutting type were significant ($\rho < 0.05$l, Table 3 and 4). The highest and lowest shoot numbers were observed in multiple bud (2.73) and single bud cuttings (1.82) respectively. Also the highest and lowest shoot numbers were observed in sand × multiple buds cutting treatment (3.00) and sand × single bud cutting treatment (0.00) respectively.

Raised bud number

Effect of medium and cutting type on raised bud numbers was not significant (Table 1). Effect of cutting type on raised bud number and interaction effect between medium type and cutting type on raised bud number is significant at $P<0.05$ (Table 3 and 4). Most raised bud numbers were observed in multiple bud cuttings (2.36) while the least raised bud numbers were observed in single bud cuttings (1) and it was middling in three bud cutting. Most raised bud numbers were seen in sand × multiple bud cutting treatment (2.66) and least one was seen in sand × single bud and peat + sand × single bud treatments (1.00).

Root length

Finally, effect of medium and cutting types and interaction effect between them on root length were significant (Tables 1, 2, 3 and 4). The longest

Table 2
Results of mean comparison of medium type on cutting parameters

	Leaf Number	Shoot Number	Raised Bud Number	Root Length
sand	12.62[a]	2.38[a]	2.07[a]	50.90[a]
sand + peat	13.00[a]	2.00[a]	1.76[a]	19.58[a]

Different letters show the significant at p<0.05

Table 3
Results of mean comparison of cutting parameters

	Leaf Number	Shoot Number	Raised Bud Number	Root Length
one bud	1.67[b]	1.00[b]	1.00[b]	0.00[b]
three buds	8.77[ba]	1.82[ba]	1.69[ba]	41.56[a]
more than three buds	19.00[a]	2.73[a]	2.36[a]	13.17[a]

Different letters show the significant at p<0.05

root length belonged to three bud cuttings (41.56cm) and the shortest ones were observed in single bud cuttings (0.00 cm). Also the longest root length were observed in sand × three bud treatment (60.75cm) and the shortest root length was observed in sand × single bud and peat + sand × single bud cutting treatments (0.00cm).

Discussion

Generally *Punica granatum* L. is propagated commercially by cuttings (Melgarejo et al., 2008; Saroj et al., 2008; Polat and Caliskan, 2009). However, there is high genetic variation in root ability among varieties with high interactive effect between varieties, IBA concentration and cutting age. Propagation by cuttings is characterized by being easy to perform, cheap and fast in growth. In addition, large number of identical plants can be obtained from one single mother plant (Howard, 1971). In our experiment, the majority of cuttings were rooted in a period of 8-10 weeks and the vegetative buds of the rooted cuttings began to grow 2-4 weeks after rooting. Propagation of the different kinds of fruit trees could be classified into easy-to-root and difficult-to-root species (Ashiru and Carlson, 1968). Our results confirmed that pomegranate is an easy-to- root species. Previous studies revealed that pre-rooting treatment with synthetic auxin (IBA) and the temperature of the root medium has marked effects in promoting rooting potential in pomegranate (Amorós et al., 1997; Hartmann et al., 1997). It is stated that a heat difference between the air and rooting medium is of prime importance to improve rooting capacity. In our experiment NAA proved to be a useful auxin for rooting. Hartmann et al. (1997) stated that for most species, daytime temperatures between 21 and 27°C and night-time temperature of 15°C, are satisfactory for pomegranate rooting. On the other hand, the same researchers indicated that there has to be a supporting heat for the cuttings in order to improve multiplication, with a heat difference between the atmosphere and the soil. Amorós et al. (1997) pointed out that hardwood cuttings of some pomegranate clones which have been subjected to base heat application during rooting improve their rooting percentage, with the positive effect being greater at 22°C than at 18°C or at normal air temperature (15.75%) and they concluded that the optimum temperature in this experiment was 22 °C. In our experiment NAA treatment as a quick dip for 10 sec was effective in inducing rooting capacity in pomegranate semi-hard and hardwood cuttings. Similarly, the results obtained by Melgarejo et al. (2008) demonstrated that IBA generally increased the percentage of rooting (although not for all concentrations). The best results were obtained with 12,000 ppm in the clones studied. Moreover, wounding carried out at the base of the cutting further increased the percentage of cuttings that rooted (Melgarejo et al., 2008).

Recognition and propagation of desired varieties while maintaining suitable properties and production of monotonous and free contamination clones to meet market demands require vegetative propagation (Talai, 1999). Melgarejo et al. (2000) studied two effective factors in rooting of pomegranate cuttings, namely, treatment of cuttings with IBA hormone and wounding their bottom concluding that

Fig. I. Three bud cuttings in sand medium

utilization of IBA (1200 ml) and wounding had the highest effects on rooting of cuttings. Subtropical fruits like pomegranate are susceptible to frost. In the aftermath of severe frosts, there is shortage of trees for propagation. The results of this study suggest that three bud cuttings with minimum height are suitable for propagation as they produce maximum root length in sand and in this case there is no need for peat.

References

Albouyeh, M. 2007. 'Study on different media and complete fertilizer effects on citrus seedling growth in hydroponic system'. Proceedings of Fifth Horticultural Congress, Shiraz University, 12-14.

Amoros, A., P. Melgarejo, L. Mondejar, M. Gimenez and R. Martinez Valero, 1997. Enraizamiento de estaquilllas de granado (*Punica granatum* L.). Actas de Hortic., 15: 484-489.

Ashiru, G. A. and **R. F. Carlson,** 1968. Some endogenous rooting factors associated with rooting of East malling II and Mallings-Mertons 106 apple clones. J. Am. Soc., 92: 106-112.

Hartmann, H.T., D.E. Kester, F.T. Jr. Davies and **R. L. Geneve,** 1997. Plant Propagation: Principles and Practices. 6th Edn., Prentice-Hall of India Private Ltd., New Delhi, India.

Hortman, H. D. and **F. D. Kester.** 2000. 'Plant propagation, principles and methods'. Shiraz University press , pages: 273.

Howard, B. H. 1971. 'Apple hardwood cuttings'. *East Malling Res. Station* 26: 22-22.

Hambrick, C. E., F. T. Davies and **H. B. Pemberton.** 1991. 'Seasonal changes in carbohydrate/nitrogen levels during field rooting of *Rosa multiflora* 'Brooks 56' hardwood cuttings'. *Scientia Horticulturae* 46 (1-2), 137-146.

Melgarejo, P., J. Martinez, J. J. Martinez and **M. Sanchez.** 2008. 'Preliminary Survival Experiments in Transplanting Pomegranate'. in: *Production, Processing and Marketing of Pomegranate in the Mediterranean Region: Advances in Research and Technology*. Melgarejo-Moreno, P., J. J. Martinez-Nicolas and J. Martinez-Tome (Eds.). Zaragoza: CIHEAM Publication, Europe, pp: 163-167.

Melgarejo, P., J. Martinez, A. Amoros and **R. Martinez.** 2000. 'Study of the rooting capacity of ten pomegranate clones (*Punica granatum* L.)'. *Adv. Res. Tech*. 1: 253-259.

Melgarejo, P., Martínez, J., Amorós, A. and **Martínez Valero, R.** 1998. Estudio de la capacidad de enraizamiento de diez clones de granado (*Punica granatum* L.). In: *1st symposium International sober el Granado , Italia.*

Mitra, S. K., D. S. Rathore, and **T. K. Bose (Eds.).** 1991. *Temperate Fruits*. Calcutta: Horticulture and Allied Publishers,.

Mohseni, A. 2003. *Recognition and introduction of best pomegranate varieties for export in Iran*. Tehran: Agriculture Jahad Ministry Press.

Moradnezhad, F. 2002. *Effect of auxin and type of stem cuttings on rooting of hardwood cuttings of pomegranate (Punica granatum) cultivars (Mahali and Malas Yazdi)*. Birjand: Birjand University.

Munzo, J. A. 1992. 'Harvest manipulation and commercialisation systems of pomegranate (*Punica granatum* L.)'. Madrid Elgranado, Mundi-prensa, ,35-39.

Owais, S. J. 2010. 'Rooting response of five pomegranate varieties to Indole Butyric Acid concentration and cutting age'. *Pak. J. Biol. Sci.* 13 (2): 51-58.

Polat, A. A., and **O. Caliskan.** 2009. 'Effect of Indole butyric acid (IBA) on the rooting cutting in various pomegranate genotypes'. *Acta. Hortic. (ISHS)* 818: 187-192.

Saroj, P. L., O. P. Awasthi, R. Bhargava and **U. V. Singh.** 2008. Standardization of pomegranate propagation by cutting under mist system in hot arid region. *Indian J. Hort.* 65, 1: 243-250.

Shirzadi, M. 2007. 'Study on the cutting type planting method and IBA different concentrations on rooting of pomegranate cuttings var. Jahrom'. Proceedings of Fifth Horticultural Congress, Shiraz University, 65-67.

Talai, A. 1999. 'Pomegranate'. *Iran Agriculture Encyclopedia*. Tehran: Agriculture Ministry Publications, Volume I, 288- 320.