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Studies on Performance of Pomegranate (*Punica granatum* L.) cv. Bhagwa Raised through Different Propagules for Yield and Quality

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A B S T R A C T

The experiment was conducted at Department of Fruit Science, IIHR, Bangalore during the year 2015. The experiment was laid out in a randomized block design with three treatments and replicated seven times. Two years old trees of pomegranate cv. Bhagwa spaced at 5.04 X 4.2 m were selected for studies. The treatment consisting of three *viz.*, T_1 (Tissue culture), T_2 (Grafted plants) and T_3 (Air layered plants). The data collected on growth, yield and quality attributes were subjected to statistical analysis by using software IIHR-DMART AND SPHR, 2014. The results indicated that tissue cultured was found to be best in terms of increasing plant height (12.45 m), canopy spread (1.62 m NS and 2.06 m EW), canopy volume (4.37 m^3), number of fruits $plant^{-1}$ (42.03) , fruit yield $plant^{-1}$ (9.39), individual fruit weight (223.53 g), fruit length (7.38 cm) fruit girth (24.88 cm), rind weight (96.68 g), aril weight (135.98 g) and rind to aril ratio (1.43) and quality attributes *viz.*, Total Soluble Solids (13.78 ^{o} Brix), titrable acidity (0.32 %) and anthocyanin content (24.10 mg 100 g^{-1}). From these results it could be concluded that plants raised through tissue culture plants improves the production and productivity of pomegranate and offers the possibility to obtain high quality fruits.

Introduction

Pomegranate (*Punica granatum* L.) so called "fruit of paradise" is one of the major fruit crops of arid region (Stover and Mercure, 2007). It is believed to have originated from Iran. India is one of the leading producers of pomegranate in the world. It is well known for its nutritive value and is rich in vitamins such as folic acid, vitamin 'c' and numerous antioxidants (Gil *et al.*, 2000). Pomegranate is one of the richest sources of riboflavin. Fruit rind, bark and root of the pomegranate contains more than 28 % gallotannic acid and dye which is useful in tanning as natural bio-dye. Pomegranates are rich in polyphenols, specially ellagic acid and punicalgins, which can act as potent antioxidants. Ellagic acid is found in the red arils of the pomegranate besides other red coloured berries. Punicalgins are found only in the outer skin of the pomegranate and are estimated to have twice the antioxidant capability of red wine and white wine (Sevda and Rodrigues, 2011). The best quality pomegranate fruits are produced in regions with cool winters and hot dry summer. Plants raised from seeds show a great variability with respect to tree vigour,

precocity, yield and fruits quality. Therefore, vegetative propagation is utmost desirable to propagate true to type plants. Keeping in view of the above problems, the present study was undertaken in pomegranate cv. Bhagwa at ICAR-IIHR, Bangalore during Ambi Bahar (2015).

Materials and Methods

Present investigation was carried out at experimental orhard of division of fruit crops, IIHR, Bangalore during the year 2015. The experimental field was located at experimental orchard of division of fruit crops, IIHR, Bangalore. The experiment was laid out in a randomized block design (RBD) with three treatments and replicated seven times. Two years old trees of pomegranate cv. Bhagwa spaced at 5.04m x 4.2 m were selected for this experiment. The detailed treatments are T_1 (Tissue culture), T_2 (Grafted plants) and T_3 (Air layered plants). Growth characters such as plant height and canopy spread were recorded during dormant period. The formula of Westwood (1978) was used to calculate the tree volume. The fruit yield was recorded at the time of harvesting. Ten fruits, per sample from each replication were taken to record the physiochemical parameters.

Fruit size in terms of length and breadth was measured with the help of vernier's calliper's. An electronic balance was used to measure the fruit weight which was expressed as gram per fruit. The TSS content of the grain juice was recorded with the help of Erma hand refractrometer and the values were expressed as degree ^{o} Brix after subjecting to correction chart at 20 ^{o} C temperature. The total titrable acidity was determined by titrating fruit juice against N/10 sodium hydroxide using phenolphthalein as an indicator. The grain juice was estimated by extracting the grain from the fruit and then squeezing in muslin cloth.

The data collected on growth, yield and quality attributes were subjected to statistical analysis by using software IIHR-DMART AND SPHR, 2014. The significance of the mean difference between the treatments was determined by computing the standard error of deviation and critical difference.

Results and Discussion

With respect to morphological and yield parameters

There was a highly significant difference in plant height. However, maximum plant height was recorded in tissue cultured plants (T_1) (2.36 m). The canopy spread on both the sides of E-W and N-S directions of the trees were significantly higher compared to other. Highest plant heights indicating larger fruiting area for obtaining higher yields. Similarly, when the tree volume was calculated, it was again more in the same treatments. When the plants raised through tissue cultured plants produced maximum canopy spread. This is negative conformity with the findings of Pareek (1978) obtained best results in terms of greatest canopy spread and largest fruits in lowest stem height trained plants in contrast to plants trained on higher stem height.

A significantly higher average number of fruits harvested from T_1 treatments as compared to grafted and air layered plants which probably resulted in higher yields in tissue cultured plants. The increase in yield in tissue cultured plants may probably be due to the larger canopy area to bear a higher number of fruits.

The larger canopy affects photosynthesis efficiency of plants which influences the cropping efficiency and cropping quality (Sansavini and Corelli, 1997). The earlier reports also indicate a positive effect on yield with a higher number of canopy area (Balasubramanyan *et al.,* 1997).

Table.1 Performance of different propagules with respect to morphological and yield parameters

Treatments	Plant height (m)	Canopy spread (NS)	Canopy spread (EW)	Canopy volume (m^3)	Number of branches $plant^{-1}$	Days taken for first ripe fruit (days)	Number of flowers $plant^{-1}$
T_1 (Tissue culture plants)	2.36	1.62	2.06	4.37	12.00	170	**120**
T_2 (Grafted plants)	1.82	1.51	1.44	2.05	8.52	185	**105**
T_3 (Air layered plants)	1.78	1.51	1.63	2.26	9.10	190	**112**
SEM	0.057	0.057	0.146	-	0.45	1.011	**3.420**
CD 5%	**0.198***	**0.199 (NS)**	**0.508 (NS)**	**-**	**1.31***	**2.120***	**7.125***

* Significant NS - Non Significant

Table.2 Performance of different propagules with respect to yield parameters

Treatments	Number of fruits $plant^{-1}$	Individual fruit weight (g)	100 grain weight (g)	Yield (kg $plant^{-1}$)	Yield /ha (kg)
T_1 (Tissue culture plants)	42.03	223.53	24.95	9.39	**3756.00**
T_2 (Grafted plants)	31.88	206.85	22.48	6.59	**2636.00**
T_3 (Air layered plants)	34.95	210.25	23.40	7.34	**2936.00**
SEM	2.81	7.76	1.15	0.49	**5.210**
CD 5%	**9.750***	**26.86 (NS)**	**3.998 (NS)**	**1.708***	**12.370***

* Significant NS - Non Significant

Table.3 Performance of different propagules with respect to fruit quality attributes

Treatments	Fruit length (cm)	Fruit girth (cm)	Rind weight (g)	Aril weight (g)	Rind to aril ratio	TSS(° Brix)	Titrable acidity (%)	Anthocyanin content (mg 100 g^{-1})
T_1 (Tissue culture plants)	7.38	24.88	96.68	135.98	1.43	13.78	0.32	**24.10**
T_2 (Grafted plants)	7.31	23.30	85.03	121.13	1.28	13.05	0.35	**21.20**
T_3 (Air layered plants)	6.68	23.33	85.95	125.53	1.29	11.4	0.37	**21.85**
SEM	0.091	0.245	3.849	3.522	0.055	0.23	0.005	**0.404**
CD 5%	**0.314***	**0.847***	**13.318(NS)**	**12.187(NS)**	**0.191(NS)**	**0.0820***	**0.019***	**1.398***

* Significant NS-Non Significant

With respect to quality parameters

Invariably the fruit size in terms of fruit length and breadth was not influence to visible level but the difference between the plants raised through different propagules.

Larger fruits were, however, produced by the plants raised through tissue cultured plants (T_1) with fruit length, breadth and weight values of 7.38 cm, 24.88 cm and 230.73 g respectively (Table 1 and 2). Higher fruit size in tissue cultured plants might be due to availability of more canopy area and solar radiation to the entire tree. However, the maximum TSS content and minimum acidity percentage of grain juice was observed in plants raised through tissue cultured plants indicating that importance of planting materials for improving fruit quality and minimum in plants raised through air layered plants.

On the basis of results obtained, it is concluded that the treatment T_1-Plants raised through tissue cultured planting materials was found to be the best in terms of maximum yield and quality of fruits.

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