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EFFECT OF GROWING MEDIA AND STORAGE OF STONE ON THE GROWTH AND DEVELOPMENT OF MANGO (*Mangifera indica* L.) ROOTSTOCK CV. LOCAL

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ABSTRACT : An experiment was conducted to study the effects of different growing media and storage of stone on mango seedling during 2012-13. Different media mixtures and storage of stones showed significant effect on morphological characters of rootstock. The highest stone germination (74.26 %), stem diameter (6.15 mm), length (27.19 cm) and girth (5.21 mm) of tap root and vigour index (4719.34) was recorded in M_3(soil + FYM + leaf mould in 1:1:1 proportion) media whereas, stone sown immediately after extraction from fully ripe mango fruit showed the maximum stone germination (94.63 %), stem diameter (6.99 mm), length (31.74 cm) and girth (6.21 mm) of tap root and vigour index (7373.68). However, the treatment M_3S_0containing mixture of soil + FYM + leaf mould with freshly extracted mango stone from ripe fruits recorded the least time to germination (22.80 days) and maximum plant height (46.60 cm), number of leaves per seedling (18.03), fresh weight of shoot (22.33 g) and root (18.50 g), dry weight of shoot (17.43 g) and root (12.10 g) accumulation.

Keywords : *Mango, media, rootstock, stone, storage.*

Mango (*Mangifera indica* L.), belongs to family Anacardiaceae, it is a National fruit of India and also known as 'King of fruits'. It is a tropical fruit originated from Indo-Burma region and grown almost all part of the world. In India it is cultivated at sub-continent for well over 4000 years. India is the largest producer of mango in the world with production of 151.88 lakh MT from an area of 22.97 lakh hectares. Among the important mango growing states of the country, Gujarat produced 9.11 lakh MT of fruit from 1.36 lakh hectares of area with productivity of 7.09 MT (Anon., 3). Mango is mostly propagated by vegetative method viz. softwood grafting and approach grafting for commercial plantation. The seedling tree has some major drawbacks. Propagation from seed, though easy and cheap, is unable to perpetuate characters of the parent tree because most commercial varieties in India are cross-pollinated and monoembryonic. Such plants are not uniform in growth, yield and fruit quality and it has long juvenile phase in comparison to vegetatively propagated fruit crops. In case of asexual method, propagation is brought by the plant parts. The asexually or vegetatively propagated fruit plants are *true to type* and are uniform in growth and fruit quality.The performance of a compound horticultural tree is determined by both rootstock and the scion (Bose *et al.,* 5). Scions are taken from the Kesar variety which is the leading commercial variety of mango in Gujarat and having good export potential because it has attractive saffron colour and oval shaped.Growing media is the important input for the containerized seedling production. It is characterized by light weight, friable, good water holding capacity, drainage, porosity and low bulk density etc. (Chakrabarti *et al.,*6). Potting medium is most important input for better seedling production. It is responsible for healthy and uniform seedling production. Apart from the selection of proper ingredients, it is also necessary to maintain the porosity of the potting mixture so that proper development of roots takes place (Srivastava *et al.,*16). Normally the viability of stone is about 90-100 days. However, it depends on the storage conditions. Stones sown immediately after extraction will exhibit viability up to 60-80 per cent depending on the variety (Radha and Mathew, 13). Looking to above fact, the present experiment was undertaken to find out effect of different media and stone storage on soft wood grafting in mango.

MATERIALS AND METHODS

The present study was conducted to find out effect of different growing media and storage of stone on success and survival of soft wood grafting in mango at LalBaug, Fruit Research Station, Department of Horticulture, Junagadh Agricultural University, Junagadh during 2012-13. The experiment was laid out in a Factorial Completely Randomized Design (CRD-F) with three repetitions and eighteen treatment combinations comprising of different growing media and storage of stones. The treatments consisted of three different growing media soil + FYM + sand (M_1), soil + FYM + rice husk (M_2) and soil + FYM + leaf mould (M_3) in 1:1:1 proportion and five storage period zero week (S_0), one week (S_1), two weeks (S_2), three

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weeks (S_3), four weeks (S_4) and five weeks (S_5). For this fully mature mangoes were selected from healthy and disease free local mango tree which were collected from ShakkarBaug Farm, Fruit Research Station, Dept. of Horticulture, JAU, Junagadhand were placed for ripening at ambient conditions. After that, stones were extracted from ripened mangoes and used for the sowing at weekly interval. After first sowing remaining stones were stored at room temperature. Stones were sown in the medium size black polythene bags having 12 inches length, width of 10 inches and 300 gauges of thickness on mid June 2012 in different growing media. Prepared rootstocks were used for softwood grafting after three months.The dataon seedling observations were recorded and analyzed by using F-test.

RESULTS AND DISCUSSION

Effect of growing media

The data given in the Table 1 showed the highest germination of stones (70.83 %), stem diameter (5.93 mm) at 90 DAS, length of tap root (25.18 cm), girth of tap root (4.77 mm) and seedling vigour index (4367.87) in media M_3 (soil + FYM + leaf mould in 1:1:1 proportion).This superiority might be attributed to the fact that in mixed soil media, the soil structure and texture was improved which in turns increases the metabolic activity in germinating seed leading to better germination of seed. The best performance of soil + FYM + leaf mould might be accredited to its richer nutritional status which enhanced photosynthetic activity resulted in more plant stored material, thereby increasing seedling girth. Similarly, minimum seedling girth may be due to less soil aeration and poor root penetration which restricted plant growth.It might be because of media containing organic manures possess organic acid within them. Therefore, more available moisture and some acids may have helped in minimum days to germination and better germination percentage (Bisla *et al.,* 4).Similar results were also reported in mango by Parasana *et. al.* (12), Radhakrishnan and Mahendran (14), Nelson *et al.* (11), Vaghamshi (19) and Teotia and Singh (18).

Effect of storage of stone

The treatment S_0 (zero week storage of stone) showed maximum germination of stones (94.63 %), stem diameter (6.99 mm) at 90 DAS, length of tap root (17.80 cm), girth of tap root (6.21 mm) and seedling vigour index (7373.68). It might be due to leakage of electrolytes and organic solutes suggested membrane deterioration as the main factor responsible for the loss of viability.These findings are in line with the results reported in mango by Tang *et al.* (17) and Musa (10) and in cashew nut by Aliyu and Akintaro (2) and Adeyemi *et al.* (1). Storage of stone also has significant effect and it might be due to the more moisture and organic solutes at the initial when extracted from

Table 1: Effect of growing media and storage of stone on stone germination, stem diameter, length and girth of tap root and seedling vigour index of mango seedlings.

Treatments	Germination of stones (%)	Stem diameter at 90 DAS (mm)	Length of tap root (cm)	Girth of tap root (mm)	Seedling vigour index
Growing Media (M)					
M_1-Soil + Sand + FYM (1:1:1)	70.83	5.93	25.18	4.77	4367.87
M_2-Soil + FYM + Rice husk (1:1:1)	72.13	5.90	26.36	4.92	4475.79
M_3-Soil + FYM + Leaf mould (1:1:1)	74.26	6.15	27.19	5.21	4719.34
CD (P = 0.05)	2.72	0.22	0.72	0.15	180.78
Storage of Stone (S)					
S_0-Zero week	94.63	6.99	17.80	6.21	7373.68
S_1-One week	93.14	6.64	17.08	6.01	6868.29
S_2-Two weeks	70.37	6.13	15.70	5.20	4330.22
S_3-Three weeks	62.40	5.68	14.64	4.47	3234.87
S_4-Four weeks	59.63	5.57	14.20	4.18	2855.96
S_5-Five weeks	54.26	4.97	13.50	3.73	2462.97
C.D. (P = 0.05)	3.85	0.31	0.72	0.21	255.65
Interaction: M x S					
CD (P = 0.05)	NS	NS	NS	NS	NS
CV%	5.55	5.37	4.84	4.52	5.91

Table 2: Interaction effect of growing media and storage of stone on days to germination, stem diameter, plant height and number of leaves of mango seedlings.

Media Storage	Days to germination				Stem diameter at 45 DAS			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_0	23.23	22.90	22.80	22.98	5.36	5.21	5.57	5.38
S_1	25.97	26.43	25.07	25.82	4.85	4.88	4.94	4.89
S_2	29.70	29.87	28.77	29.44	4.55	4.50	4.48	4.51
S_3	30.63	30.00	29.83	30.16	4.20	4.10	4.46	4.25
S_4	30.07	29.93	30.43	30.14	4.26	4.54	4.36	4.39
S_5	36.90	34.43	33.27	34.87	3.24	3.86	4.26	3.79
Mean	29.42	28.93	28.36		4.41	4.51	4.68	
Interaction (M × S)								
CD (P = 0.05)			1.16				0.43	
CV%			2.42				5.69	
Media Storage	**Plant height at 90 DAS**				**Number of leaves at 90 DAS**			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_0	46.07	46.03	46.40	46.17	17.78	17.90	18.03	17.91
S_1	41.03	43.32	44.24	42.86	16.80	16.70	17.67	17.06
S_2	34.83	34.23	34.32	34.46	14.80	15.35	16.37	15.51
S_3	32.79	24.28	27.20	28.09	12.30	13.27	14.70	13.42
S_4	25.46	24.72	26.87	25.68	12.43	12.73	13.20	12.79
S_5	23.01	24.29	24.34	23.88	11.77	12.60	12.70	12.36
Mean	33.86	32.81	33.90		14.31	14.76	15.44	
Interaction (M × S)								
CD (P = 0.05)			1.78				0.75	
CV%			3.21				3.04	

fruits.Similarly, Franchise *et al.* (8) concluded that recalcitrant seeds, such as mango are characteristically shed from the mother plant with high moisture content and thereafter remain sensitive to desiccation resulting viability loses as they losewater.

Interaction effect of growing media and storage of stone

The data pertaining to interaction effect of growing media and storage of stone on the growth parameters of rootstock are presented in Table 2 and 3. It has significant effect on the days to germination, plant height, number of leaves per seedling, fresh weight and dry weight of shoot and root etc.The treatment M_3S_0 containing mixture of soil + FYM + leaf mould (1:1:1) with zero week storage of stones requires the minimum days (22.80 DAS) for germination and also showed maximum plant height (26.71 and 46.60 cm) and number of leaves per seedling (7.27 and 18.03) at 45 and 90 DAS. However, it also recorded maximum fresh weight of shoot (22.33 g) and root (18.50 g), dry weight of shoot (17.43 g) and roots(12.10 g) and stem diameter (5.57 mm) at 45 DAS. Thus, it might be due to mutual complementary effect of these two factors. The vigorous and fast growth of seedlings may be attributed to better water holding capacity and availability of nutrients for plant growth in soil + FYM + leaf mould and also because of higher amount of energy, organic solutes and electrolytes provided by the stone.Increase in the number of leaves was mainly due to corresponding increase in the plant height.There was a non-significant result of the interaction effect of growing media and storage of stone on the germination percentage of stones, stem diameter at 90 DAS, length and girth of tap root and seedling vigour index.This may be attributed to general improvement in the physical

Table 3: Interaction effect of growing media and storage of stone on fresh and dry weight of shoot and root of mango seedlings.

Media Storage	Fresh weight of shoot				Fresh weight of root			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_0	22.33	20.00	22.33	21.56	12.50	16.67	18.50	15.89
S_1	21.00	21.50	21.17	21.22	13.17	15.33	17.33	15.28
S_2	19.17	19.33	19.67	19.39	14.00	15.83	16.17	15.33
S_3	15.67	17.67	18.67	17.33	12.00	13.50	14.17	13.22
S_4	14.67	15.83	17.50	16.00	13.50	15.50	13.67	14.22
S_5	13.17	13.33	16.50	14.33	12.00	12.50	13.50	12.67
Mean	17.67	17.94	19.31		12.86	14.89	15.56	
Interaction (M × S)								
CD (P = 0.05)			1.96				1.72	
CV%			6.45				7.19	
Media Storage	**Dry weight of shoot**				**Dry weight of root**			
	M_1	M_2	M_3	Mean	M_1	M_2	M_3	Mean
S_0	17.40	15.83	17.43	16.89	7.13	10.07	12.10	9.77
S_1	16.27	16.57	17.03	16.62	7.20	9.80	11.80	9.60
S_2	13.90	14.53	14.87	14.43	7.47	9.63	10.40	9.17
S_3	11.67	12.83	12.90	12.47	6.77	9.13	9.40	8.43
S_4	10.07	10.37	10.80	10.41	7.53	8.43	8.47	8.14
S_5	8.83	9.60	9.93	9.46	6.93	8.20	8.60	7.91
Mean	13.02	13.29	13.83		7.17	9.21	10.13	
Interaction (M × S)								
CD (P = 0.05)			0.51				0.65	
CV%			2.29				4.47	

and chemical properties of the rooting medium which improved the fresh weight and dry weight also (Deelip *et al.,* 7). The better nutrient availability leading to higher production of photo-synthetically functional leaves in these treatments finally resulting in better girth of seedling (Gera *et al.,* 9). Similar results were also obtained by Shergill *et al.* (15) in ber (*Zizyphus mauritiana* Ram.).

Conclusion

Results clearly indicated that the treatment M_3S_0 containing mixture of soil + FYM + leaf mould in 1:1:1 proportion with zero to two week storage of stones helped in appreciating the growth and development of mango rootstock because the different growing media provides the proper aeration and nutrients for the containerized seedlings while, mango stones used immediately after extraction had abundant moisture percentage which helps in retaining the maximum viability. Due to recalcitrant nature of the mango stones, they lose their viability when stored for more than six weeks at ambient temperature.

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