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Effect of potting media on survival and growth performance of rebagged of cashew grafts cv. Vengurla 4

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Abstract

The experiment was carried out to study survival and growth performance of cashew grafts in different type of potting media suitable for six month old cashew grafts transplanted in large size polybags at Department of Horticulture, College of Agriculture Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri during the year 2018. The experiment was conducted in Randomized Block Design with five treatments and four replications. The five treatments consist of T₁: Control (Soil + FYM 3:1), T₂: Soil + FYM (1:1), T₃: Cocopeat (100%), T₄: Soil + Cocopeat (1:3) and T₅: Soil + FYM + Rice husk + Cocopeat (1:1:1:1). The results showed significant difference in survival percent, plant height (cm), length of new sprout (cm), girth of the graft (mm), root length, dry root weight and relative growth rate on height basis. The significantly highest survival (93.00%), plant height (74.51 cm), girth (11.64 mm), root weight (23.20) as well as maximum root length (47.45 cm) were obtained in T₅ i.e. Soil + FYM + Rice husk + Cocopeat (1:1:1:1) medium.

Keywords: Cashew, grafts, media, rebagged

Introduction

The Cashew (*Anacardium occidentale* L.), is horticultural plantation crop brought to India by Portuguese travelers during 16th Century but now adapted well in Indian conditions. It is grown along the coastal regions of Maharashtra, Goa, Karnataka and Kerala in the West Coast and Tamil Nadu, Andhra Pradesh, Odisha and West Bengal in the East Coast. It is spreading in non-traditional areas such as Bastar region of Chhattisgarh and Plain regions of Karnataka, Gujarat, Jharkhand and in North East Hilly region. Due to its high nutritional value and increasing affordability by the consumers, demand for cashew continues to increase both in India and in foreign countries. The cashew cultivated area in India during 2016-17 was 10.62 lakh hectares with an annual production of 8.17 lakh metric tones of raw cashewnuts. Maharashtra is a much advanced state for horticulture which occupies large area 1.915 Lakh Ha (Salvi *et al.*, 2018) ^[20] under cashew crop. Konkan region of Maharashtra state has constitutes 1,86,200 hectares area under cashew that covers 19.20 percent of total area under cashew in India.

Latest trend of farmers to establish mango and cashew orchard is to plant grafts of more than one year age in big size polybags, because of higher survival and better and early establishment in the field, However during rebagging lot of mortality can be observed, as cashew is very delicate to rebagging due to root damage. This necessitates to standardize technology for rebagging and growing of cashew grafts in large size bags. Efforts were made to minimize the weight of large size polybag cashew grafts by mixing light weight potting mixture or substrate. Farm yard manure (FYM) is one of the widely used organic manure. Besides providing essential elements to the plants, FYM also improves soil structure by improving its aeration, water holding capacity and cation exchange capacity. Cocopeat which is an agricultural by product obtained from coconut husk, is considered as a good growing medium component with acceptable pH, electrical conductivity and other chemical attributes (Abad *et al.*, 2002) ^[2]. It has good physical properties, high total pore space, high water content and low shrinkage, low bulk density and slow biodegradation (Evans *et al.*, 1996; Prasad, 1997) ^[8, 28]. Soil and carbonated rice husk media mix and soil and cocoa pod husk media mix increased significantly the plant height, stem diameter, number of leaves, leaf area and total dry matter weight (Gifty 2014) ^[10].

The present day nursery practices involve much cost and risks with respect to raising of grafts. In the nursery activities, the preparation of medium, should receive considerable attention of

the nursery owners. While raising grafts for each horticultural crop, specific medium should be suggested or recommended for satisfactory growth of the plant or grafts. It is possible to manipulate the physical and chemical properties of the medium suitable for better growth of the graft

Different growing media other than soil like coco peat, rice husk and FYM are light in weight and are having good porous structure so easily transported from one place to other. Cashewnut need to be transferred intact with media along the root ball, otherwise it will cause defoliation leads to death of graft. Very less work has been found in use of other media and performance of Cashew grafts in nursery. Therefore present study was undertaken with objective to find out the suitable potting medium for rebagging cashew grafts in large size polybags.

Material and Methods

The experiment was conducted at nursery number-1, Department of Horticulture, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.) India, 415712. It was conducted in Randomized Block Design with five treatments and four replications. The experimental materials used for the study were different media components soil, FYM, cocopeat and rice husk as a potting media.

Potting mixture was prepared separately for each treatment. The required quantities of different components were mixed

on volume basis as per the treatment detail. Rebagging in big size polybag (10"x14") was done to standardize the medium in large size polybags. The observations were recorded 90th, 180th days after transplanting.

The survival of grafts was recorded at 30th, 90th and 180th days after transplanting (DAT). The grafts height (cm) was measured with wooden scale from collar region up to apical end of shoot. The scion girth was measured by digital Vernier calipers scale at just above the grafts union. The number of functional leaves per grafts was counted visually. Length of tap root from three selected grafts from each replication of all treatment combinations were estimated at the end of experiment (i.e. six months after transplanting with the help of measuring scale and average tap root length is expressed in centimeter. Dry weight root per graft of selected three grafts was recorded at the end of experiment (i.e. six months after transplanting). Roots were dried in hot air oven at 60°C. Drying was continued until samples attained constant weight. In two constant weights of roots was recorded as dry weight. The rate of increase in height (cm) per time and expressed as cm/cm/day. RGR was calculated by the formula given by Briggs *et al.*, (1920) [20]. Where, H₂ and H₁ represent the graft height per plant at t₂ and t₁ times, respectively.

Results and Discussion

The data regarding survival percentage of cashew grafts as affected by different potting media are presented in Table 1.

Table 1: Effect of media on survival percentage of Rebagged cashew grafts cv. Vengurla 4. (Figures in parenthesis indicate arcsine transformed values)

Treatments	Survival Per cent		
	30 DAT	90 DAT	180 DAT
T ₁ : Soil +FYM (3:1) Control	96.00(78.65)	93.50(75.25)	88.50(70.19)
T ₂ : Soil + FYM (1:1)	95.50(77.80)	95.00(77.14)	89.50(71.15)
T ₃ : Cocopeat (100%)	97.50(82.39)	96.50(79.50)	92.00(73.63)
T ₄ : Soil + Cocopeat (1:3)	97.00(80.16)	96.00(78.46)	90.00(71.60)
T ₅ : Soil + FYM + Rice husk + Cocopeat (1:1:1:1)	99.00(85.93)	97.50(81.08)	93.00(74.85)
Mean	80.98	76.84	72.28
S.E.±	1.61	1.48	1.12
C.D. at 5%	4.96	3.23	2.45

The data presented in Table 1 indicate that significantly maximum survival percentage (93.00%) was observed in T₅ (i.e. Soil + FYM + Rice husk + Cocopeat 1:1:1:1). All other treatment showed less survival percentage. At 90 DAT, statistically highest per cent survival in T₅ (97.50) and T₃ (96.50) was recorded in treatment T₅ (i.e. Soil + FYM + Rice husk + Cocopeat 1:1:1:1) and T₃ (cocopeat 100%), while significantly lowest per cent survival was observed in treatment T₁ (93.50) followed by T₂ (95.00).

At 180 DAT, the significantly highest per cent survival of grafts was recorded in treatment T₅ (93.00) (i.e. Soil + FYM + Rice husk + Cocopeat 1:1:1:1) which was at par with T₃ (92.00) (Cocopeat 100%). The lowest per cent survival was recorded in treatment T₁ (88.50) (i.e. Soil + FYM 3:1) and T₂ (89.50) (i.e. Soil + FYM 1:1).

The higher percent survival was observed in media having cocopeat along with soil, rice husk and FYM which helped in growth of graft by maintaining equilibrium in water and nutrient supplied. The minimum survival percent observed in T₁ (soil + FYM 3:1) might be due to water logging and damage to the roots of the graft.

The higher success of grafting is depend on congenial

environmental conditions prevailing during the period following grafting and rapid sap flow in stock and scion which might have favored the healing process and caused early callus formation and as a result established the continuity of cambium and vascular tissues for sprouting and ultimately higher plant survival (Chandel *et al.*, 1998; Pathak and Srivastava, 1973) [9, 27].

Similar finding were reported by Dengale (1980) [7] in soil + FYM(3:1), Bisla *et al.*, (1984) [6] recorded lower mortality per cent (0.95) of per seedling in sand and soil (1:1) growing medium, Gangandeeep Kaur and Malhi (2006) [9] in soil + FYM + sand (1:1:1), Aatla (2011) [1] in soil + FYM + sand (1:1:1) in mango and Ragaji (2017) [17] in soil + FYM (3:1) followed by soil + cocopeat (1:1) media for stone grafts of mango.

The data pertaining to percent increase in plant height are presented in Table 2. It is observed from data that there was significant increase in plant height of Rebagged cashew grafts at 90, and 180 DAT among different treatments. Significantly maximum increase in plant height (74.52) was observed in T₅ (Soil + FYM + Rice husk + Cocopeat 1:1:1:1) which was at par with T₄ (Soil + Cocopeat 1:3). All other treatments

showed minimum increase in plant height.

Physiological activity in successful grafts produces new shoot and leaves. More number of shoot and leaves triggered the process of photosynthesis which resulted in accumulation of energy. Simultaneously availability of moisture, nutrient through media (Ikram *et al.*, 2012) [16] resulted in more sprouting followed by increasing morphological characters like height, girth and number of leaves. Media pH ranged near neutrality promote higher uptake of nutrient in media

containing FYM, rice husk and cocopeat which was of also supported by retention moisture and proper aeration. Hence more increase in height was obtained in media containing FYM, cocopeat and rice husk (T₅, T₄ and T₂). Similar findings were reported by Gifty (2014) [10] observed that soil + carbonated rice husk, Panchal *et al.*, (2014) [24] observed that the soil + cocopeat + FYM (1:1:1), Kurava (2015) [20] in soil, FYM and fertilizer media in mango.

Table 2: Effect of different media on height of cashew grafts cv.Vengurla-4. (Value in parenthesis indicates per cent increase)

Treatments	Height of cashew grafts		
	0 DAT	90 DAT	180 DAT
T ₁ : Soil +FYM (3:1) Control	40.94 (0.00)	49.42 (26.04)	61.60 (57.98)
T ₂ : Soil + FYM (1:1)	44.87 (0.00)	55.47 (24.11)	67.37 (50.37)
T ₃ : Cocopeat (100%)	49.96 (0.00)	58.43 (17.32)	67.92 (36.74)
T ₄ : Soil + Cocopeat (1:3)	43.79 (0.00)	51.53 (17.62)	61.28 (40.16)
T ₅ : Soil + FYM + Rice husk + Cocopeat (1:1:1:1)	49.24 (0.00)	60.87 (23.51)	74.52 (51.58)
Mean	0	21.73	47.37
S.E.±	0	1.51	2.42
C.D. at 5%	0	4.68	7.47

The data presented in Table 3 indicate that increase in plant girth. It is observed from data that there was significant increase in plant girth of rebagged cashew grafts at 90, and 180 DAT among different treatments. Significantly maximum plant girth (11.64 mm) was found in treatment T₅ (Soil + FYM + Rice husk + Cocopeat 1:1:1:1) which was at par with T₂ (Soil + FYM 1:1). However significantly lowest plant girth was found in treatment T₄ (Soil + cocopeat 1:3) (10.00 mm). Grafts containing media mixture with proper aeration, moisture and substantial amount of nutrients, facilitate root absorption for formation of photosynthates. It helped in cell division, cell elongation and adequate water supply resulted in increase in percent of girth of grafted plants.

The media containing rice husk and cocopeat triggered the growth of grafts faster than soil by increasing photosynthesis activity. Hence increase in girth was obtained in media containing cocopeat and rice husk (T₅). Similar findings were reported by Kelkar (2016) [18] for mango in media containing top soil + FYM + Vermiphose and Ragaji (2017) [17] in soil + cocopeat (1:1) for mango. Lad (2018) [13] for mango grafts in media cocopeat + leaf manure + compost (1:1:2).

Table 3: Effect of different media on girth of cashew grafts cv.Vengurla-4.

Treatments	Girth of cashew grafts (mm)		
	0 DAT	90 DAT	180 DAT
T ₁ : Soil +FYM (3:1)Control	6.67	7.92	10.93
T ₂ : Soil + FYM (1:1)	7.64	8.42	11.34
T ₃ : Cocopeat (100%)	7.26	7.91	10.74
T ₄ : Soil + Cocopeat (1:3)	7.37	8.15	10.00
T ₅ : Soil + FYM + Rice husk + Cocopeat (1:1:1:1)	6.46	8.32	11.64
Mean	7.08	8.14	11.13
S.E.±	0.33	0.08	0.12
C.D. at 5%	N.S	0.26	0.39

The data presented in Table 4 indicate that increase in number of leaves. It is observed from data that there was significant increase in number of leaves of rebagged cashew grafts at 90, and 180 DAT among different treatments. Significantly maximum number of leaves in treatment T₂ (34.50) and T₁

(31.65). While the lower number of leaves was observed in treatment T₃ (14.35). The mixture of soil and FYM contained proper equilibrium of nutrient, moisture and aeration resulted in faster physiological activity in successful grafts. The driving force for cell elongation and multiplication was favored by soil moisture, humidity and temperature which produced favorable effect on number of leaves on scion (Bodkhe and Rajput, 2010) [7]. Similar findings were also reported by in Herle (1998) [15] for tamarind, in the medium sand + coir dust + soil + compost (1:1:1:1 v/v), Aatla (2011) [1] in media containing in soil + FYM + sand (1:1:1) in mango, Waseem *et al.*, (2013) in soil + leaf mold + coconut husk (33:33:33) and Ragaji (2017) [17] in media containing leaf manure.

Table 4: Effect of different media on number of leaves of cashew grafts cv.Vengurla-4.

Treatments	Number of leaves		
	0 DAT	90 DAT	180 DAT
T ₁ : Soil +FYM (3:1) Control	7.00	20.40	31.65
T ₂ : Soil + FYM (1:1)	7.25	21.95	34.50
T ₃ : Cocopeat (100%)	9.00	15.10	14.35
T ₄ : Soil + Cocopeat (1:3)	8.80	18.60	16.40
T ₅ : Soil + FYM + Rice husk + Cocopeat (1:1:1:1)	8.55	18.20	25.20
Mean	8.12	18.85	24.42
S.E.±	0.75	1.27	2.16
C.D. at 5%	N.S	3.92	6.67

The data presented in Table 5 indicate that relative growth rate. It is observed from data that there was significant increase in relative growth rate of rebagged cashew grafts at 90 and 180 DAT among different treatments. Significantly maximum RGR on height basis was found in treatment T₁ (0.0064 cm/cm/day) (i.e. Soil + FYM 3:1), while T₅ (0.0060) (i.e. Soil + FYM + Rice husk + Cocopeat 1:1:1:1) and minimum in T₃ (0.0045 cm/cm/day) (i.e. cocopeat 100%). The maximum relative growth rate on height basis was observed in media containing soil and FYM because of stimulatory effect of soil along with FYM. This might have attributed to the significant increase in plant height and growth and

ultimately increased RGR. Similar finding was reported by Kurava (2015) [20] in media containing soil, FYM and fertilizer for mango, Kelkar (2016) [18] in top soil + FYM + Vermiphose media for mango, Ramteke *et al.*, (2016) [30] where maximum relative growth rate of papaya seedlings was obtained in media soil + FYM (1:1) and Ragaji (2017) [17] for mango stone grafting in soil + leaf manure (1:1) in media

Table 5: Effect of different media on relative growth rate of cashew grafts cv.Vengurla-4.

Treatments	Relative Growth Rate (cm/cm/day)		
	30 DAT	90 DAT	180 DAT
T ₁	0.0010	0.0032	0.0064
T ₂	0.0007	0.0031	0.0059
T ₃	0.0007	0.0023	0.0045
T ₄	0.00063	0.0023	0.0049
T ₅	0.0008	0.0030	0.0060
Mean	0.0008	0.0028	0.0055

At the end of the six month, the root length was significantly influenced by the different potting media treatments. The root length varied from 35.43 cm to 47.45 cm. The significantly highest root length was recorded in the treatment T₅ (47.45 cm) (i.e. soil + FYM + rice husk + cocopeat 1:1:1:1). The significantly lowest root length was recorded in T₄ (35.43 cm) (i.e. soil + cocopeat 1:3). Among the various media containing cocopeat and rice husk with soil showed increase in the root growth. Easy availability of nutrient, aeration leads to proper gas exchange by maintaining sufficient oxygen supply to the root. Simultaneously removal of respiratory CO₂ helped in root elongation (Heikonen, 1993) [37]. Similar findings were reported by Parmar *et al.*, (2015) [26] for custard apple in soil + vermicompost + rice husk (1:2:1) and Ragaji (2017) [17] for mango stone grafting in soil + cocopeat (1:1) and leaf manure + cocopeat (25:75) media.

Table 7: Effect of different media on cost of production (B: C ratio) of cashew Cv. Vengurla 4 softwood Grafts

Sr. No.	Treatments	Weight of bag approx. (gm)	Total number of survival grafts	Expenditure incurred 100 grafts (Rs.)	Gross return of survival graft X (Rs. 110/graft)	Net profit	B:C ratio
1	T ₁	6534	88	8487.31	9735	1247.69	1.14
2	T ₂	5749	89	8505.31	9845	1339.69	1.15
3	T ₃	4060	92	9667.81	10120	452.19	1.04
4	T ₄	4451	90	9033.56	9900	866.44	1.09
5	T ₅	4860	93	8788.56	10230	1441.44	1.16

Conclusion

The significantly highest survival percent (93.00%), plant height (74.52 cm), girth (11.64 mm), dry root weight (23.20) as well as maximum root length (47.45 cm) were obtained in T₅ i.e. Soil + FYM + Rice husk + Cocopeat (1:1:1:1) while maximum number of leaves (34.50) in T₂ i.e soil + FYM (1:1) and highest RGR (0.0064 cm/cm/day) in T₁ i.e Soil + FYM (3:1). The potting medium Soil + FYM + Rice husk + Cocopeat (1:1:1:1) proved best in terms of survival & growth after six months of transplanting in large size polybag (10"x14").

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Table 6: Effect of potting media on root length and dry root weight of cashew grafts.

Treatments	At 180 days	
	Root length (cm)	Root Weight(g)
T ₁	36.45	13.80
T ₂	38.55	14.86
T ₃	38.85	12.39
T ₄	35.43	12.05
T ₅	47.45	23.20
Mean	39.34	15.26
S.E.±	2.52	1.98
C.D. at 5%	7.80	6.08

The dry root weight was significantly influenced by the different potting media treatments. The maximum weight of dry root is T₅ (23.20) and minimum weight is T₄ (12.05). Media mixture containing soil with FYM, cocopeat and rice husk medium showed maximum dry weight of root.

Steady moisture and nutrient supply in the root zone motivate shoot and root growth, proper drainage and aeration also helped in root respiration and other metabolic activities resulted in maximum root development (Chatterjee and Choudhari, 2007) [10]. Similar findings were reported by Panchal *et al.*, (2014) [24] for khirni seedlings in soil + cocopeat + FYM (1:1:1) media, Gifty (2014) [10] for cocoa seedling in soil + cocoa pod husk (1:1) and Ragaji (2017) [17] for mango graft in soil + cocopeat (1:1) media

The cost of production for different potting media was under study is given in Table no. 7. In which maximum net profit (Rs. 1441.44/-) given from T₅ Soil + FYM + Rice husk + Cocopeat (1:1:1:1) was promoting with highest B: C ratio (1.16) which was close to T₂ (1.15) i.e. Soil + FYM (1:1) with net profit (Rs. 1339.69/-) and T₁ (Soil +FYM (3:1) with B: C ratio (1.14).

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