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GROWTH AND DEVELOPMENT OF FIG (*FICUS CARICA*) CV. BLACK ISCHIA CUTTINGS UNDER DIFFERENT GROWING MEDIA

Chandan Kumar*, Dheeraj Singh, Bhola Ram Kuri and M.K. Ahirwar

ICAR-Central Arid Zone Research Institute, K.V.K., Pali- Marwar - 306 401 (Rajasthan), India.

*Corresponding author E-mail: chandan.kumar@icar.gov.in

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ABSTRACT

Vegetative production techniques, of which cutting method widely used in propagation of ornamental as well as fruit plants, have a crucial role in multiplication. On rooting development of stem cuttings and growing media are some of the critical factors that affect the success. The primary objective of this study is to determine the best stem cutting type and ideal growing media for fig (*Ficus carica*) cv. Black Ischia. The research was conducted at the model nursery of ICAR-Central Arid Zone Research Institute, K.V.K., Pali-Marwar (Rajasthan), India during two successive seasons from July-September, 2022 and 2023. This research was arranged in a complete randomized design with two types of cutting and nine treatment combinations of growing media with three replications. The results showed that the minimum days taken for first sprouting, highest number of sprouting, roots per cutting, percentage of rooted cutting, root length, number of leaves, plant height and survival percentage of cuttings was recorded significantly highest in hardwood cutting saplings and treatment T_7 (50% Pond soil + 25% River sand + 25% Vermicompost) was significantly best growing media in respectively both years of experimentation. As fig culture in India is at very nascent stage, this cutting technique and suitable composition of growing media will help in the quick spread of sapling.

Key words : Sapling, cutting, Growing media, Sprouting, Vermicompost.

Introduction

Fig (*Ficus carica*) is an important fruit crop grown as subtropical or tropical crop, especially in arid and semiarid regions of the world. The common fig is a member of the genus *Ficus*, which is in the family Moraceae (mulberries). *Ficus* is a large genus with some 2,000 tropical and subtropical tree, shrub, and vine species distributed around the warmer parts of the world. The only *Ficus* cultivated for their fruit are the species *F. carica* (the common fig) and *F. sycamorus* (the sycamore fig of Egypt). *Ficus carica,* is one of the ancient fruits known to mankind, which also finds its mention in the Bible. It is reported to be under cultivation from 3000-2000 BC in the eastern Mediterranean region. Figs have recently attracted a great deal of attention and are widespread throughout the world. The world produces over one million tons of figs yearly, of which 82% are produced in Mediterranean countries (FAO, 2009). The fig is an economically important fruit species which is growing traditional method by fig cuttings from one- or two-year-old shoots and directly planting them in soil to obtain new trees the success of propagation by stem cutting is very limited due to its low capacity for adventitious root formation limiting its commercial production by growers and nursery owners who have encountered difficulty and recorded very low survival rate in their propagation (Rzepka-Plevnes and Kurek, 2001). Most of the present gardeners still use, mainly, top soil for their planting operations even though it is bulky and heavy, very inconsistent in quality and environmentally unfriendly because it results in continuous depletion of the topsoil (Hall, 2003). There is therefore the need to encourage the use of composted organic biomass in agriculture in developing alternatives to soil media. In the

nursery production industry, a variety of growing media are used worldwide, mixtures of the different proportions can however, give satisfactory plant growth. As fig is tolerant to saline and alkaline there is vast scope for extending its cultivation in such soil and thereby increasing fig production. There is an ever increasing demand for planting material in India. Very less research work has so far been done on propagation of fig by cuttings using different growing media. Therefore, it is felt necessary to undertake the study on propagation of fig by using different growing media under semi arid and saline conditions at K.V.K. for quicker multiplication in model nursery. Considering these circumstances, the present study was carried out to investigate the effect of growing media on rooting of cuttings of fig.

Materials and Methods

The experiment was conducted in the nursery (established by NHB), of the ICAR-Central Arid Zone Research Institute, Krishi Vigyan Kendra, Pali-Marwar located at 25.801428^0 North latitude and 73.291048^0 East longitudes in state of Rajasthan (India) during two successive years from July-September, 2022 and 2023. The soil of the experimental field was sandy clay loam in texture while depth of soil is moderate to deep about 50 to 75 cm. It is suitable for cultivation but for low rainfall and high evaporation causes saline (pH 7.93 to 8.20) nature. Organic carbon at the farm field soil ranges from 0.22 to 0.33% and Nitrogen in surface layer is low (231.75 to 277.00 Kg/ha) whereas P_2O_5 (14.33 to 15.00 Kg/ha) and K_2O (210.33 to 214.33 Kg/ha) is medium. The mean minimum and maximum annual temperature was 4.1°C and 41.2°C, respectively and total mean rainfall was 323.21 and 450.30 mm during the experiment year 2022 and 2023, respectively. The present study was arranged in a complete randomized design (CRD) with two types of cutting and nine treatment combinations of growing media (Pond soil, River sand and Vermicompost) with three replications and has 50 polybags of each treatment. Cuttings from healthy parent stock of *Ficus carica* cv. Black Ischia was obtained from the mother orchard at KVK. Two types of cuttings; semi-hardwood (taken from partially mature wood) and hardwood cuttings (taken from dormant mature stems) were obtained from healthy parent stock. The length for each cutting was 25 cm; at this length had 3-6 nodes of previous season used as planting material (Hartmann *et al.*, 2002). All cuttings were obtained very early in the morning using a pair of multipurpose garden scissors (Secatear). The semi-hardwood and hardwood cuttings were stripped of its lower leaves 2 cm from the base of cuttings. Before planting, all stem cutting types were dipped in 4000mg/l IBA rooting media.

The different media served as the 9 levels and it was formulation were: 100% Pond soil; 100% River sand; 100% Vermicompost; 50% Ponds soil+50% River sand; 50% Pond soil+50% Vermicompost; 50% River sand+50% Vermicompost; 50% Pond soil+25% River sand+25% Vermicompost; 50% River sand+25% Pond soil+25% Vermicompost; 50% Vermicompost+25% River sand+25% Pond soil. Pond soil and river sand were collected from the nearby village and it was exposed to solar radiation (heat from the sun) for one week in order to kill pathogenic organisms. Vermicompost has obtained from KVK and they were mixed manually to improve movement of water in the different media, dissolve nutrients and oxygen in the media making it easy for plant roots to absorb. Perforated polythene bags of dimension 15 cm × 10 cm were filled with equal volumes of each media; before cuttings were inserted into the different media, they were moistened and allowed to settle overnight. A dibber was used to create a hole for the insertion of the cuttings. The cuttings were then inserted to about half its length in the rooting media maintaining the vertical orientation of the stem (ensuring that the cuttings are not upside down). After inserting the cuttings in an upright form, the medium was firmed around the cuttings. The cuttings were spaced adequately to allow all the leaves receive sunlight and then watered regularly. Emerging opportunistic weed seedlings were removed by regular handpicking throughout the duration of the experiment and the cuttings were sprayed with a systemic fungicide, Bavistin-50% WP carbendazim; after they were set, to control disease incidence on the stem cuttings this was repeated four weeks after planting. Data were collected on the following parameters from randomly selected five sprouted cuttings from each treatment in each replication.

1. **Days to first sprouting:** This was the number of days for the cuttings of fig to first sprout beginning from days after planting.
2. **Numbers of sprouting:** This was sprouting number taken at the four weeks after planting (WAP).
3. **Number of roots per cutting:** This was the number of roots formed on each cuttings; evaluated at the end of the experiment (90^{th} days after planting).
4. **Percentage of rooted cuttings (%):** This was the observed number of cuttings that had successfully rooted recorded at the end of the experiment. It was calculated by using the following formula on 90^{th} days of planting.

Percentage of rooted cuttings (%)

$$= \frac{\text{Number of cuttings rooted}}{\text{Total number of cuttings}} \times 100$$

5. **Root length per cutting (cm):** The root length was measured using meter rule from the point of attachment of the roots to the distal end of the stem cuttings at the end of the experiment.
6. **Number of leaves per cutting:** This was taken at when the experiment was terminated (90th days after planting).
7. **Plant height (cm):** This was the cumulative growth (cutting length + new growth) of nursery plant also taken at end of the experiment.
8. **Survival percentage (%) of cuttings:** The total number of survival percentage under each treatment in each replication was recorded and calculated on the 90th days after planting (DAP).

All counts data was subjected to analysis of variance (ANOVA) to calculate significant differences and differentiation of mean at a significant level of 5%. The analysis was conducted by using the OPSTAT (Sheoran *et al*., 1998) statistical package.

Results Discussion

Perusal of data (Tables) of two years (2022 & 2023) and its mean showed that all growth and development parameters of fig cv. Black Ischia were significantly affected by different type of cuttings and growing media composition.

Days to first sprouting: The result showed that the data of days to first sprouting was significant varied among the different type of stem cuttings (Table 1) and media (Table 3) in both years (2022 and 2023) and its mean. The recorded mean of minimum number of days (20.94) taken for first sprouting in hardwood cutting saplings while semi hardwood cuttings taken maximum number of days (23.26) to first sprouting. The mean of T_7 (50% Pond soil + 25% River sand + 25% Vermicompost) media was recorded significantly minimum days to first sprouting (19.00), while maximum days to first sprouting (25.65) was observed in T_2 (100% River sand) media. This might be due to synergic effect of media and type of cutting. The present study is in conformity with the results reported by Khapare *et al*. (2012) in fig cv. Dinkar.

Number of sprouting: Observations on number of sprouting differed significantly among different of types of cutting (Table 1) and media composition (Table 3). The significantly highest mean of number of sprouting (2.39) was observed in Hardwood stem cutting saplings while in semi hardwood stem cutting (1.39) recorded lowest and the significantly highest mean of number of sprouting (3.01) was observed in T_7 (50% Pond soil + 25% River sand + 25% Vermicompost) media composition while lowest number was observed in T_2 (100% River sand) media. It is well known that the success of rooting of the woody stem cuttings, in the majority of ornamental plants and fruit trees depends mainly on the physiological stage of the mother plant (Darwesh, 2000). Wahab *et al*. (2001) also reported that sprouting is mainly attributed to

Table 1 : Effect of different types of stem cuttings on growth and development of Fig cv. Black Ischia.

Treatments (Types of stem Cuttings)	Days to first sprouting			Numbers of sprouting			Number of roots per cutting			Percentage of rooted cuttings (%)		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
C_1 = Semi hardwood	24.06	22.48	23.26	1.86	1.99	1.93	17.62	17.19	17.40	36.33	37.04	36.68
C_2 = Hardwood	21.29	20.60	20.94	2.28	2.50	2.39	17.13	16.84	16.98	41.47	42.78	42.13
S.E. ±	0.17	0.17	0.12	0.08	0.08	0.07	0.20	0.21	0.15	0.32	0.35	0.25
C.D. (P=0.05)	0.50	0.48	0.36	0.24	0.23	0.21	NS	NS	NS	0.93	1.02	0.72

Table 2 : Effect of different types of stem cuttings on growth and development of Fig cv. Black Ischia.

Treatments (Types of stem Cuttings)	Root length per cutting (cm)			Number of leaves per cutting			Plant height (cm)			Survival percentage (%) of cuttings		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
C_1 = Semi hardwood	16.96	16.83	16.89	3.73	4.03	3.88	20.93	20.51	20.72	51.67	53.88	52.78
C_2 = Hardwood	17.96	18.10	18.03	4.50	4.65	4.57	21.33	21.36	21.35	57.49	59.32	58.40
S.E. ±	0.18	0.19	0.12	0.10	0.08	0.06	0.21	0.21	0.14	0.51	0.46	0.35
C.D. (P=0.05)	0.52	0.56	0.36	0.30	0.24	0.18	NS	0.60	0.41	1.47	1.32	1.01

Table 3 : Effect of different types of media composition on growth and development of Fig cv. Black Ischia.

Treatments (Types of media)	Days to sprouting			Number of sprouting			Number of roots per cutting			Percentage of rooted cuttings (%)		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
T_1 = (100% Pond soil)	24.23	22.38	23.30	1.55	1.69	1.62	15.00	14.41	14.70	36.32	35.90	36.11
T_2 = (100% River sand)	26.07	25.25	25.65	1.35	1.65	1.50	13.62	13.32	13.47	36.27	35.57	35.92
T_3 = (100% Vermicompost)	24.03	23.07	23.53	1.82	2.06	1.94	18.50	17.27	17.88	39.00	39.25	39.13
T_4 = (50% Pond soil + 50% River sand)	23.02	21.57	22.28	2.17	2.15	2.16	17.50	18.08	17.79	38.80	40.42	39.61
T_5 = (50% Pond soil + 50% Vermicompost)	21.90	20.00	20.95	2.26	2.49	2.38	18.78	18.00	18.39	39.25	40.72	39.99
T_6 = (50% River sand + 50% Vermicompost)	21.22	21.47	21.32	2.48	2.45	2.47	16.83	18.17	17.50	39.25	41.20	40.23
T_7 = (50% Pond soil + 25% River sand + 25% Vermicompost)	19.35	18.67	19.00	2.95	3.06	3.01	19.17	18.30	18.74	32.55	43.03	42.79
T_8 = (50% River sand + 25% Pond soil + 25% Vermicompost)	21.40	19.95	20.67	2.10	2.36	2.23	18.77	17.76	18.26	39.27	41.02	40.14
T_9 = (50% Vermicompost + 25% River sand + 25% Pond soil)	22.85	21.53	22.18	1.99	2.32	2.15	18.18	17.82	18.00	39.42	42.06	40.74
S.Em. ±	0.37	0.35	0.26	0.18	0.17	0.15	0.42	0.45	0.31	0.69	0.75	0.53
C.D. (5%)	1.06	1.01	0.75	0.52	0.50	0.44	1.20	1.30	0.89	1.98	2.15	1.52

the stored carbohydrates in the cuttings used for sprouting. The effect of stem cutting and media type influenced early sprouting with an exception observed in 100% River-sand (T_2) this may be attributed to the fact that River-sand was too porous and could not keep enough humidity required by the cuttings.

Number of roots per cutting: The number of roots per cutting was recorded non-significant with type of stem cuttings in every year of trial (Table 1), while the media composition effect was significantly varied to each year. The mean of number of roots per cutting was recorded highest (18.74) in T_7 (50% Pond soil + 25% River sand + 25% Vermicompost) media which was at par with T_8 = (50% River sand + 25% Pond soil + 25% Vermicompost), T_9 = (50% Vermicompost + 25% River sand + 25% Pond soil), T_5 = (50% Pond soil + 50% Vermicompost) and T_3 = (100% Vermicompost) media composition while lowest mean of number of roots per cutting was recorded in T_2 (100% River sand) media (Table 3). Media composition was affected the regeneration of roots on cuttings it promotes rooting of stem cuttings. The results obtained were in conformity with Hore and Sen (1992) in fig, Upadhyay and Badyal (2007) in pomegranate.

Percentage of rooted cuttings: Hardwood cutting recorded the highest percentage mean of rooted cutting *i.e.* 42.13% at 90 DAP (Table 1). Among media composition the percentage mean of rooted cutting was significantly varied to each treatment (Table 3) the maximum percentage of rooted cutting (42.79%) was recorded in T_7 (50% Pond soil + 25% River sand + 25% Vermicompost) treatment media and minimum (35.92%) was recorded in T_2(100% River sand) media. This might be due to the fact that hardwood cutting contain more starch which in turn bring about favourable conditions

Table 4 : Effect of different types of media composition on growth and development of Fig cv. Black Ischia.

Treatments (Types of media)	Root length per cutting (cm)			Number of leaves per cutting			Plant height (cm)			Survival percentage (%) of cuttings		
	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean	2022	2023	Mean
T_1 = (100% Pond soil)	14.68	13.59	14.14	3.95	4.15	4.05	18.70	17.46	18.08	47.80	45.67	46.73
T_2 = (100% River sand)	14.09	13.82	13.96	3.45	3.68	3.56	18.11	17.66	17.89	41.55	43.44	42.50
T_3 = (100% Vermicompost)	17.44	17.49	17.47	4.25	4.38	4.32	20.95	21.04	21.00	48.31	51.34	49.83
T_4 = (50% Pond soil + 50% River sand)	17.09	17.63	17.36	3.96	4.27	4.12	20.60	20.83	20.72	49.18	56.77	52.98
T_5 = (50% Pond soil + 50% Vermicompost)	18.16	17.96	18.06	4.07	4.28	4.18	21.79	21.64	21.72	56.30	60.59	58.45
T_6 = (50% River sand + 50% Vermicompost)	19.38	18.89	19.13	4.52	4.48	4.50	22.87	22.45	22.66	57.56	60.74	59.15
T_7 = (50% Pond soil + 25% River sand + 25% Vermicompost)	20.06	20.31	20.18	4.62	5.18	4.90	23.73	23.72	23.73	64.97	64.39	64.68
T_8 = (50% River sand + 25% Pond soil + 25% Vermicompost)	18.01	18.37	18.19	3.95	4.27	4.11	21.47	21.33	21.40	62.21	62.87	62.54
T_9 = (50% Vermicompost + 25% River sand + 25% Pond soil)	18.25	19.10	18.68	4.27	4.38	4.33	21.97	22.28	22.13	63.33	63.56	63.45
S. Em. ±	0.38	0.41	0.26	0.22	0.17	0.13	0.45	0.44	0.30	1.08	0.97	0.74
C.D. (5%)	1.11	1.18	0.76	0.63	0.50	0.38	1.31	1.27	0.87	3.11	2.81	2.14

for root initiation and more rooting percentage coupled with positive response of media composition. The present finding is in conformity with Reddy *et al.* (2008 b) in fig.

Root length per cutting: The highest mean root length per cutting (18.03 cm) was noted in hardwood stem cutting (Table 2) and least mean root length per cutting was noted (16.89 cm) in semi hardwood cutting. The significant effect of media was noted (Table 4) for the parameter of root length per cutting, the maximum root length was noted in T_7 (50% Pond soil + 25% River sand + 25% Vermicompost) treatment media and minimum (25.92 %) was recorded in T_2(100% River sand) media. The increase in root length may be due to type of stem cuttings and growing media composition because it enhances the histological features like formation of callus and tissue and differentiation of vascular tissue. It has also effect on the metabolites translocation and carbohydrates metabolism. The results are in close proximity to the findings of Reddy *et al.* (2008 a) in fig and Santos *et al.* (2011) in *Annona muricata*.

Number of leaves per cutting: Significantly maximum mean number of leaves per cutting (4.57) was recorded in the hardwood cutting as compared to semi hard wood cutting (Table 2). The growing media composition was significantly affected on number of leaves per cutting, the maximum mean of number of leaves was noted in T_7 (50% Pond soil + 25% River sand + 25% Vermicompost) treatment media and minimum (25.92%) was noted in T_2(100% River sand) media (Table 4). It might be due to co-effect of type of cutting and growing media composition. The results are conformity with Siddiqui and Hussain (2007) in *Ficus hawaii* cutting.

Plant height: Data in Tables 2 and 4 showed that plant (Sapling) height of fig cv. Black Ischia was

significantly influenced by types of cutting and different media composition. The mean of plant height of cutting was highest in hardwood stem cutting (21.35 cm). Among the different media composition treatments, similarly T_7 *i.e.* media having 50% Pond soil + 25% River sand + 25% Vermicompost recorded maximum plant height (23.73 cm), whereas T_2(100% River sand) media had minimum plant height (17.89 cm). It might be due to positive effect between the type of cuttings and growing media composition. Above result is in conformity with the findings of Ramos *et al*. (2008) in fig. Promising results in plant growth and development with combined application of Pond soil, Rivers and Vermicompost in the treatment T_7might be attributed to the conducive effect of this media composition on water holding capacity, porosity, soil aeration and supplying substantial amount of nutrient specially nitrogen and micro nutrients for improving root and shoot growth (Chopde *et al.*, 1999).

Survival percentage (%) of cuttings : Hardwood cutting recorded significantly the highest survival percentage of cuttings *i.e.* 58.40% at 90 days after planting as compared to semi hard wood cutting (52.78%). This might have resulted from development of effective root system and increase in number and length of roots per cutting which might have influenced the uptake of water and nutrients. The present study is in conformity with findings of Reddy *et al*. (2008 a) in fig. The growing media had also significantly affected the survival percentage of cuttings among these media the T_7 (50% Pond soil + 25% River sand + 25% Vermicompost) treatment noted maximum survival percentage of cutting (64.68 %), which was at par with T8 (50% River sand + 25% Pond soil + 25% Vermicompost) and T9 (50% Vermicompost + 25% River sand + 25% Pond soil) growing media composition, whereas minimum survival percentage (42.50%) was noted in T_2(100% River sand) media treatment. Vermicompost had positive effect on root development, which is helpful in increasing survival percent of sapling in main field after transplanting. So, on the basis of results obtained from present study, it can be concluded that the types of cuttings and growing media significantly influenced the growth and development of sapling of fig cv. Black Ischia.

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