Environment and Ecology 42 (1A) : 271—276, January—March 2024
Article DOI: https://doi.org/10.60151/envec/EBHK2406
ISSN 0970-0420

Effect of Different Soil Media on Rooting of Dragon Fruit Cuttings

A. D. Ingole, U. A. Raut, S. P. Mahalle, Ajay Kumar

Received 10 August 2023, Accepted 12 December 2023, Published on 6 March 2024

ABSTRACT

The present study was carried out at the Fruit Nursery, Department of Fruit Science, Dr Panjabrao Deshmukh Krishi Vidypeeth, Akola.With the aim to investigate the effect of various compositions of soil media and to find the proper composition for better rooting of dragon fruit cuttings. The design of experiment was CRD with five replications consisting of seven treatment combinations viz., T_1-Soil:Sand:-FYM, T_2-Soil:Red Soil:FYM, T_3-Soil:Silt:FYM, T_4-Soil:Sand:Vermicompost, T_5-Soil:Red Soil:Vermicompost, T_6-Soil:Silt:Vermicompost with ratio of 2:1:1 and T_7 was control (100% Soil). All the data were recorded on different growth parameters of selected representative cuttings which were selected at random from each replication. Treatment T_5 i.e. Soil:Red Soil:Vermicompost in ratio 2:1:1 displayed superior performance articulated in terms of root growth parameters viz., number of root per cutting (58.2), root length (21.54 cm), root diameter (2.36 mm), length of longest root (23.66 cm), average number of roots (53.62), average length of root (20.96 cm), root volume (1.82 cc), fresh weight of root (5.18 g), dry weight of root (0.86 g) and survival percentage (97.59%) among different treatments for successful propagation of dragon fruit cuttings.

Keywords Cuttings, Dragon fruit, Propagation, Rooting, Soil media.

INTRODUCTION

Dragon fruit is a newly introduced super fruit in India. It is regarded as a promising, profitable fruit crop. It has a very attractive color and delicious pulp with a black color edible seed embedded in the pulp. Dragon fruit has outstanding nutritive properties, which attract growers from all over India to cultivate this fruit crop. It is reported to be originated from Mexico, Central, and South America.

The difficulty in cultivation of dragon fruit is scarcity of high-quality cuttings as planting material. Plant propagation is a critical phase in dragon fruit

A. D. Ingole[1], U. A. Raut[2*], S. P. Mahalle[3], Ajay Kumar[4]

[2] Associate Professor
[1,2,3] Department of Fruit Science, Dr Panjabrao Deshmukh Krishi Vidyapeeth, Akola 444104, Maharashtra, India

[4] Department of Fruit Science, Banda University of Agriculture and Technology, Banda 210001, Uttar Pradesh, India

Email: ujwalraut1977@gmail.com
*Corresponding author

cultivation so as to ensure availability of quality planting material. The availability of dragon fruit seedlings can be increased by vegetative propagation by stem cutting. Asexual propagation of dragon fruit by cuttings is time-saving and easy. The combination of different growing media is crucial for the success of dragon fruit propagation and its cultivation. The choice of growing medium depends on availability, cost of production, and its suitability in biological, physical as well as chemical properties (Barrett *et al.* 2016). Topsoil is a limited non-renewable resource. This topsoil is in high demand so nurseries must look for alternative mediums for propagation. Moreover, the removal of topsoil harms local ecosystems. The success is reported higher in the different combinations of propagation media than in soil. Organic fertilizer may be used to enhance the availability of nutrients in soil media (Mubarok *et al.* 2017). Adopting different combinations of growth media for propagation has higher odds of success. Organic materials are full of macro and micro pores, if used as a planting medium it is beneficial for plants. A large amount of explants is needed for the large-scale establishment of a dragon fruit plantation in a new area needs. Dragon fruit can be easily propagated by the use of cuttings. However, the shortage of cutting material is an obstacle to the production of explants on a large scale. Therefore, the growing media of dragon fruit is a crucial factor in the success of dragon fruit propagation (El Obeidy 2006) and the propagation technology can be used for large-scale nursery production of dragon fruit.

MATERIALS AND METHODS

Media combinations

Pot mixture was prepared by mixing Soil:Sand:FYM for T_1, Soil:RedSoil:FYM for T_2, Soil:Silt:FYM for T_3, Soil:Sand:Vermicompost for T_4, Soil:RedSoil:Vermicompost for T_5, Soil:Silt: Vermicompost for T_6 in ratio of 2:1:1 and T_7 was control with soil 100%. The black polyethylene bags (11.5 × 26 cm) were filled with appropriate rooting media which was prepared according to treatment.

Planting of cuttings and aftercare

Dragon fruit cuttings of white-fleshed variety were manually collected from the dragon fruit field of the Department of Fruit Science, PDKV, Akola. Mature cuttings of equal size were procured from a year-old terminal shoot with approximately 4-5 nodes. The average length of cuttings was about 15-20 cm. Cuttings were shade dried for a day before planting for complete drying of the ooze coming out from the fresh cuttings. The basal portion of selected cuttings is dipped in Indole Butyric Acid (IBA) solution for 15 minutes. The plants were covered with a shade net. Watering and weeding were done at regular intervals. To check the disease the rooting medium was drenched with carbendazim (0.15%) at fortnight intervals. Plants were supported by sticks.

Data collection and analysis

The experiment was laid out in Completely Randomized Design (CRD) with seven treatments which were replicated five times. Three plants of each treatment and each replication were selected, marked, and kept under observation for recording shoot growth observations. The same three cuttings were uprooted carefully after heavy irrigation and washed under the tap water gently to record root growth observation. The data collected on various observations, during the investigation, were statistically analyzed by Completely Randomized Design (CRD) (Panse and Sukhatme 1967). The analysis was carried out at the computer research center, Directorate of Research, Dr PDKV, Akola during the year 2020-2021. The experiment was carried out at Fruit Nursery of Department of Fruit Science, College of Horticulture, Dr PDKV, Akola. Analytical work was carried out at the analytical laboratory, Department of Fruit Science, Dr PDKV, Akola during the year 2021-22.

RESULTS AND DISCUSSION

The results of the experiment were analyzed at Fruit Nursery of Department of Fruit Science, Dr PDKV, Akola during the year 2021-2022. The results of the investigation were based on the observation of various rooting parameters of dragon fruit cuttings which were recorded during the investigation. The recorded observation is presented and discussed as under.

We found significant differences among all obser-

Plate 1. Root growth of dragon fruit cuttings subjected to different soil media.

vations of dragon fruit cuttings to different growing media as revealed by most of their root morphological attributes as represented in Plate 1.

The number of roots per cutting of dragon fruit varied from 40.2 to 58.2. Maximum number of roots per cutting (58.2) was observed in treatment T_5 i.e. Soil: Red Soil: Vermicompost; which was superior over the rest of the treatment, followed by T_1 i.e. Soil: Sand: FYM (55.4). The minimum number of root per cutting (40.2) was found in treatment T_7 i.e. control as presented in Table 1 and Fig. 1. Different chemical and physical properties of the growth media resulted in a higher number of roots (Khayyat *et al.* 2007). The pH of the growing medium is crucial for the availability of all mineral nutrients to the plant. Maximum availability of nutrients occurs between 5.5 and 6.5 pH in the growing media such as organic soils (Ratha *et al.* 2014). Our result corroborates the findings (El-Obeidy 2006, Rahad *et al.* 2016, Sudarjat *et al.* 2018, Chahal 2020) in dragon fruit cuttings.

The root length of dragon fruit cuttings, varied from 21.54 to 13.66 cm. Maximum root length (21.54 cm) was observed in T_5 i.e. Soil: Red Soil: Vermicompost; which was superior over the rest of the treatment followed by T_1 i.e. Soil: Sand: FYM (19.88 cm). The minimum root length (13.66 cm) was found in the treatment T_7 control. The data is analyzed according to the details outlined in Table 1

Table 1. Effect of different growing media on shoot and root growth.

Treatments	Number of root per cutting	Root length (cm)	Length of longest root (cm)	Root diameter (mm)	Root volume (cc)	Average length of root (cm)	Average number of roots	Fresh weight of root (g)	Dry weight of root (g)	Survival percentage (%)
T_1	55.4	19.88	22.12	2.18	1.70	19.24	51.86	4.42	0.82	90.98 (72.52)
T_2	49.4	17.92	21.28	1.98	1.62	18.52	51.12	4.28	0.77	86.58 (68.51)
T_3	43.2	15.32	17.62	1.62	1.36	16.88	48.18	3.78	0.66	78.97 (62.70)
T_4	51.4	16.48	20.12	1.82	1.58	17.62	49.16	3.64	0.74	81.37 (64.42)
T_5	58.2	21.54	23.66	2.36	1.82	20.96	53.62	5.18	0.86	97.59 (81.06)
T_6	48.4	16.18	18.66	1.68	1.43	16.72	47.22	3.62	0.71	79.76 (63.26)
T_7	40.2	13.66	15.94	1.44	1.25	14.92	44.56	3.02	0.62	59.95 (50.73)
'F' test	SIG	SIG	SIG	SIG	SIG	SIG	SIG	SIG	SIG	SIG
SE (m) ±	0.60	0.27	0.15	0.056	0.024	0.18	0.30	0.13	0.013	1.01
CD at 5%	1.75	0.80	0.44	0.163	0.071	0.53	0.89	0.40	0.039	2.95

Behavior of dragon fruit cuttings.
*Figures in parenthesis are ArcSin transformation values.

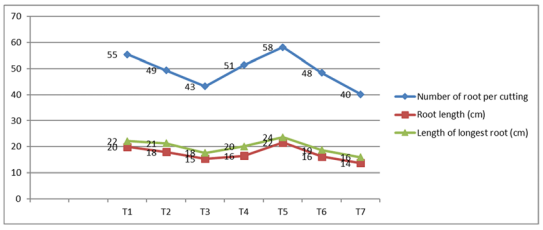

Fig. 1. Graphical representation of the effect of different compositions of soil media on number of root per cutting, root length and length of the longest root.

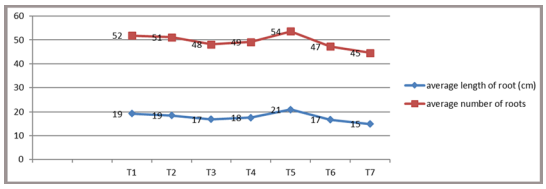

Fig. 2. Graphical representation of the effect of different compositions of soil media on average length of root (cm), and average number of roots .

and Fig. 1. It might be due to the addition of organic matter which increases soil porosity, which assists the growth of the roots. Low-porosity conditions in the soil medium inhibited root growth (Sudarjat *et al.* 2018). Our result corroborates these findings (El-Obeidy 2006, Rahad *et al.* 2016, Chahal 2020, and Sudarjat *et al.* 2018), in dragon fruit and pomegranate cuttings by Deshmukh *et al.* (2019).

The length of the longest root of dragon fruit cuttings was observed to range from 23.66 to 15.94 cm. The maximum length of the longest root (23.66 cm) was observed in treatment T_5 i.e. Soil: Red Soil: Vermicompost; which was superior over the rest of the treatment. Followed by treatment T_1 i.e. Soil: Sand: FYM (22.12 cm). The minimum length of the longest root (15.94 cm) was found in treatment T_7 i.e. control. The analysis follows the specifics provided in Table 1 and Fig. 1. Similar results were reported in dragon fruit (El-Obeidy 2006, Rahad *et al*. 2016, Chahal 2020, and Sudarjat *et al.* 2018).

The root diameter of dragon fruit cuttings was recorded in a range of 2.36 to 1.44 mm. Maximum root diameter (2.36 mm) was recorded in treatment T_5 i.e. Soil: Red Soil: Vermicompost; which was superior over the rest of the treatment. Treatment T_1 i.e. Soil:Sand:FYM (2.18 mm) was statistically at par with treatment T_2 i.e. Soil: Red Soil: FYM (1.98 mm). The analysis follows the specifics provided in Table 1 and Fig. 2. A minimum root diameter (1.44 mm) was found in treatment T_7 i.e. control. The above results might be due to the higher concentration of organic compounds in the media leads to increased nutrient absorption through a greater number of roots (Deshmukh *et al.* 2019) also increase in root volume results in an increase in root diameter. The present findings conform to the results in dragon fruit (Rahad *et al*. 2016, Chahal, 2020, Sudarjat *et al.* 2018), in pomegranate cuttings (Deshmukh *et al.* 2019), and in guava cuttings (Qadri *et al.* 2018).

The root volume of dragon fruit cuttings varied from 1.25 to 1.82 cc. Maximum root volume (1.82 cc) was observed in treatment T_5 i.e. Soil: Red Soil: Vermicompost; which was superior over the rest of the treatment. Followed by treatment T_1 i.e. Soil: Sand: FYM (1.70 cc). A minimum root volume (1.25 cc) was found in treatment T_7 i.e. control. The data is analyzed according to the details outlined in Table 1. Vermicompost has an extensive surface area, enabling it to absorb and hold nutrients effectively. This allows it to retain a higher quantity of nutrients over extended periods (Gopinath *et al.* 2010). The present findings conform to the results in dragon fruit (Rahad *et al.* 2016), (Chahal 2020), (Sudarjat *et al.* 2018), pomegranate cuttings (Deshmukh *et al.* 2019), and in guava cuttings (Qadri *et al.* 2018).

According to data presented in Table 1 and Fig. 2. the average length of the root of dragon fruit cuttings varied from 14.92 to 20.96 cm. The maximum average length of root (20.96 cm) was observed in treatment T_5 i.e. Soil: Red Soil: Vermicompost; which was superior over the rest of the treatment. Treatment T_1 i.e. Soil: Sand: FYM (19.24 cm) was statistically at par with treatment T_2 i.e. Soil: Red Soil: FYM (18.52 cm). The minimum average length of root (14.92 cm) was found in treatment T_7 i.e. control. The growth enhancement is attributed to the plant hormone-like activities associated with the microflora in vermicompost and the metabolites produced from secondary metabolism (Gopinath *et al.* 2010). Similar

results were reported in dragon fruit (El-Obeidy 2006, Rahad *et al.* 2016, Chahal 2020, Sudarjat *et al.* 2018).

The average number of roots of dragon fruit cuttings varied from 53.62 to 44.56. The maximum average number of roots (53.62) was observed in treatment T_5 i.e. Soil: Red Soil: Vermicompost; which was superior over the rest of the treatment. Treatment T_1 i.e. Soil: Sand: FYM (51.86) was statistically at par with treatment T_2 i.e. Soil: Red Soil: FYM (51.12). A minimum average number of roots (44.56) were found in treatment T_7 i.e. control. The increased rooting capability of the cuttings in red soil media is linked to its lower pH level of 4.0 and the abundant presence of micronutrients, specifically iron, manganese, and zinc, which are known to promote root growth (Schwambach *et al.* 2005). The data is analyzed according to the details outlined in Table 1, Fig. 2.The present findings are in conformity with the results in dragon fruit cuttings (El-Obeidy 2006, Rahad *et al.* 2016, Sudarjat *et al.* 2018, Chahal 2020), mahogany cutting (Sondarva *et al.* 2017), Phalsa (Singh *et al.* 2018), and pomegranate cuttings (Deshmukh *et al.* 2019).

As presented in Table 1 the fresh weight of the root of dragon fruit cuttings varied from 3.02 to 5.18 g. Maximum fresh weight of root (5.18 g) was observed in treatment T_5 i.e. Soil: Red Soil: Vermicompost; which was superior over the rest of the treatment. Followed by treatment T_1 i.e. Soil: Sand: FYM (4.42 g). The minimum fresh weight of root (3.02 g) was found in treatment T_7 i.e. control. This could be because vermicompost is rich in essential vitamins, enzymes, micronutrients, and hormones such as auxins and gibberellins (Sondarva *et al.* 2017). The fresh weight of roots is directly influenced by the increases in length of roots and a number of roots. (Deshmukh *et al.* 2019). Similar results were reported in dragon fruit (Santos *et al.* 2010, Rahad *et al.* 2016, Chahal 2020), lime cv Loomi (Abdullah and Al-Khateeb 2004), and pomegranate (Manila *et al*. 2017, Deshmukh *et al.* 2019) cuttings.

The dry weight of the root of dragon fruit cuttings varied in range of 0.62 to 0.86 g. A maximum dry weight of root (0.86 g) was observed in treatment T_5 i.e. Soil: Red Soil: Vermicompost; which was superior over the rest of the treatment followed by treatment T_1 i.e. Soil: Sand: FYM (0.82 g). A minimum dry weight of root (0.62 g) was found in treatment T_7 i.e. control. The analysis follows the specifics provided in Table 1. The increases in dry weight of roots have directly influenced the length of roots, and the number of roots. The present findings are in conformity with the results in dragon fruit (Rahad *et al.* 2016, Chahal 2020, Dhruve *et al.* 2018), pomegranate (Deshmukh *et al.* 2019), and mahogany cuttings (Sondarva *et al.* 2017).

The survival percentage of dragon fruit cuttings, which varied between 59.95 % to 97.59 % . Maximum survival percentage (97.59 %) was observed in treatment T_5 i.e. Soil: Red Soil: Vermicompost which was superior over the rest of treatment. Followed by T_1 i.e. Soil: Sand: FYM (90.98%). A minimum survival percentage (59.95%) was found in treatment T_7 i.e. Control. This could be attributed to the high C:N ratio, its antifungal properties, and the increased space provided by the combination of red soil and vermicompost in the rooting media. Such factors contribute to a surge in the number of roots, leading to optimal root density (Dehmukh *et al.* 2019). The present findings are in conformity with the results in dragon (El-Obeidy 2006, Rahad *et al.* 2016, (Sudarjat *et al.* 2018, Chahal 2020), lemon cutting (Kumar *et al.* 2015), and pomegranate cutting (Deshmukh *et al.* 2019, Rathwa *et al.* 2017. The data regarding root growth parameters is presented in Table 1.

CONCLUSION

Based on findings represented in the present study the response of different compositions of soil media on root growth of dragon fruit cuttings were found significant and resulted in better root growth performance of propagated cuttings was observed in the treatment T_5 i.e. Soil:Red Soil:Vermicompost in ratio 2:1:1.

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