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Influence of Shade Net and Open Field Nursery Conditions and Growing Media on Survival Characters of Rooted Layers in Guava (*Psidium guajava* L.)

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ABSTRACT: The guava plants can be propagated by seed, inarching, layering, cutting, budding and grafting. But air-layering is the best method of propagation for this crop. The percentage of survival and survival of rooted layers in open field nursery conditions is very poor and is not achieving up to an expectation of the demand at cheaper rate with high survival and survival percentage. Polyhouse nursery condition is the alternative to an open nursery conditions. The plantlets of different layered plants were studied under polyhouse and open field nursery for their survival and growth characters during 2017-18. Where there was use of four bagging media *viz.*, soil, sand and FYM (1:1:1) (M_1), soil, sand, FYM (1:1:1) and vermiwash @ 1 % (M_2), soil, sand, vermicompost (1:1:1) and vermiwash @ 1 % (M_3), soil, sand, poultry manure (1:1:1) and vermiwash @ 1 % (M_4) with shade net (E_1) and open field nursery conditions (E_2). The results revealed that, among nursery conditions plant kept under shade net with bagging media of soil, sand, FYM (1:1:1) and vermiwash @ 1 % showed significantly minimum number of days taken for appearance of sprouts (11.70), maximum number of sprouts (5.78), number of leaves (23.12), number of shoots (5.42), number of primary roots (42.12), number of secondary roots (79.94), survival percentage of rooted air layers (81.98%) at 60 days after bagging (DAB), While, minimum survival percentage of rooted air layers was observed under open condition with a mixture of soil, sand, poultry manure (1:1:1) and vermiwash @ 1 % of 30 DAB (61.97 %).

Keywords: guava, bagging media, nursery conditions, vermiwash.

INTRODUCTION

Guava (*Psidium guajava* L.), the apple of the tropics, is one of the most popular fruits grown in tropical, sub-tropical and some parts of arid regions of India. Guava belongs to the family Myrtaceae, having chromosome number 2n=22 and is one of the hardy crops being cultivated throughout Karnataka state and is widely distributed throughout the tropical and sub-tropical regions of the world. It is cultivated in India since early 17th century. Guava being a hardy crop is grown in variety of soils and climatic conditions. However, the suited to red loams, medium black and other well drained soils. The guava plants can be propagated by several ways such as seed, cuttings, air layers, grafting etc. The seed propagation was wide spread earlier, now it restricted to raising of rootstock material. The vegetative propagations by air layering are becoming more and more popular on account of their cheaper cost, ease of propagation and good success rate. However, great deal of variation in per cent success is observed in air layering. One of the causes for variation has been observed to be the age of shoots used in air layering. The success in layering of guava and other fruit crops depends upon mother plants, time of layering, rainfall, humidity, temperature, rooting media, growth media, plant growth regulators and nursery conditions. In the modern times, air layering technique using growth regulators during rainy seasons is being used to achieve more success (Tyagi and Patel 2004). Maximum survival percentage of air layers might be due to better water holding capacity of media as well as more number of primary and secondary roots, number of leaves etc. The increase in yield is attributed mainly to an improvement in root development, an increase in the rate of water and mineral uptake by roots. While, maximum number of leaves might be due to the availability of more mineral nutrients and water due to efficient absorption by vigorous root system. The results are in respect to IBA also in conformity with finding of Rymbai and Reddy (2011). The rooting media such as sand, soil, saw dust (Tyagi and Patel

2004), moss grass (Kumar and Syamal 2005), poultry manure, Vermi compost and Farmyard manure (Singh *et al.*, 2007) etc., are being used to improve the scope of air layering in guava. Similar results were also obtained by Singh *et al.* (1996); Karunakara (1997); Kumar and Syamal (2005); Singh *et al.* (2007) in guava. The higher percentage of survival after transplanting the rooted air-layers can be attributed to the possession of better root characters like higher number and length of roots. The increase in shoots might be due to early initiation of roots, more numbers of roots, root length, numbers of leaves etc., which increased the absorption of nutrients from the rooting medium and thereby increased the shoot length. The results are quite comparable with the results of Patel *et al.*, (1989) as well as Tyagi and Patel (2004). Maurya *et al.* (2012) observed that "the air layering are made with soil and dung + sphagnum + 6000 mg IBA / L showed early emergence of the roots (16.33 days), increase in the number of primary roots (17.49), secondary roots (47.73), the maximum root length (10.20 cm), fresh root (3.31g) and dry root weight (0.68g) compared to control Singh *et al.*, (2007) observed that in Air layering of guava *cv.* Lucknow-49 treated with IBA concentration of 6000 ppm with soil: sand: poultry manure rooting media produced maximum percentage (76.75%) of survival of 60-days-old-plants grown in poly bags. This combination of IBA with rooting media helped in producing maximum number of primary roots (18.57), secondary roots (23.91), leaves on 60 days (14.36) and length of shoots on 60 days (5.31 cm). IBA 5000 ppm and poultry manure combination was found to be second best for survival of air layering (73.25%). Reddy *et al.*, (2014) reported maximum fresh and dry weight of shoots (34.10g, 35.96g and 43.53g) at 45, 60, and 75 DAP with the application of IBA 3000 mg/l , poultry manure and sphagnum moss as rooting media on air layers of Fig *cv.* Poona produced. Alloli *et al.* (2001) reported the beneficial effects of fly ash were more pronounced in fig, which produced the highest fresh and dry weight of roots in this media. Fly ash was the most ideal media for fig, while sawdust was the most ideal for pomegranate. Rathore (2006) observed in guava layering that rooting was 100% in the treatments including compost, loamy soil and cow dung and 60-70% in saw dust. The mean number of primary roots was the highest in compost and lowest in saw dust. Rathore (2006) conducted an experiment of guava layering. He found that rooting was 100% in the treatments including compost, loamy soil and cow dung and 60-70% in saw dust. The mean number of primary roots was the highest in compost and lowest in saw dust. However, the percentage of establishment and survival of rooted airlayered plants in open conditions is very meager and is not achieving up to an expectation of the demand with higher establishment and survival percentage. A polyhouse is a type of specialized structure that utilizes the controlled climate condition for the growth of different plants and other farming needs. We use polythene sheets to cover the structure and separate the internal environment from that of the outside. Polyhouse technology has been in use for crop production in more than fifty countries all over the world. It creates microclimate surrounding the crops that help in maximum growth regarding production of crops and increases the survival of the plants.

MATERIALS AND METHODS

The experiment was carried out during 2017-2018, at the Main Agricultural Research Station, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka on a nursery block of guava Cv. Allahabad Safeda. Trees were planted at 2 × 2m spacing, the period of layering was done in 3 months with different rooting media and two nursery conditions were used that is open conditions (E_1) and Shade net (E_2). The observations were recorded at 90 days after layering.

The selected plants were healthy, well matured, uniform and vigorous. These selected plants were kept under ideal cultural practices, the flowers and fruits were frequently removed from the layer shoots during the course of studies. The selected shoot was 6 to 7 months old and of pencil thickness with an average length of 60cm and showing brown streaks on the bark. In a selected shoots, a ring of bark about 2 to 2.5 cm were girdled carefully by giving two circular cuts about 45-60cm below the top end of a shoots and the exposed portion was rubbed. The exposed region was applied with Rootex (bio hormone powder) after that covered with a ball of different rooting media without disturbing the applied growth regulator. The rooting media was covered with polythene tubing of 250 gauge thickness and both the ends were secured firmly using gunny thread to minimize the evaporation of moisture

These layer shoots were detached from the parent plants at 90 days after layering, 10 of the successful rooted layers were transplanted into a polybag (10 × 15 cm) containing four different bagging media combinations *viz*., soil, sand and FYM (1:1:1) (M_1), soil, sand, FYM (1:1:1) and vermiwash @ 1 % (M_2), soil, sand, vermicompost (1:1:1) and vermiwash @ 1 % (M_3), soil, sand, poultry manure (1:1:1) and vermiwash @ 1 % (M_4) for studying their survival under open conditions (E_1) and shade net (E_2). Observations for rooting percentage and root characters were taken at 90 days after layering and for survival percentage and other survival characters were taken at 30 and 60 days after transplanting. The experiment was laid out in Factorial RBD. Each treatment was replicated three times and each replication consists of 10 layers. The data were analyzed as per the procedure of Panse and Sukhatme (1978).

RESULT AND DISCUSSION

The results showed that nursery conditions had significant effect on rooting attributes of layered plants at 60 days after bagging presented in table 1. Among nursery conditions plants kept under shade net at 60 DAB resulted the maximum number of primary roots (39.60), length of longest primary roots (10.35 cm), diameter of primary roots (1.67 mm), number of secondary roots (70.63), as compared to plant kept under open condition at 30 DAB. Among the various bagging media, mixture of soil, sand, FYM (1:1:1) and vermiwash @ 1 % at 60 DAB were recorded maximum number of primary roots (39.65), length of longest primary roots (10.29 cm), diameter of primary roots (1.87 mm), number of secondary roots (72.06). While, least no of these rooting characters was observed in bagging media with mixture of soil, sand, poultry manure (1:1:1) and vermiwash @ 1 % at 30 DAB.

The interaction effect between nursery conditions and rooting media had significant influence on the rooting characters represented in table 2. A maximum number of primary roots (42.12), length of longest primary roots (10.81 cm), diameter of primary roots (1.93 mm), number of secondary roots (77.96), were observed under shade net at 60 DAB with mixture of soil, sand, FYM (1:1:1) and vermiwash @ 1 %. However, minimum value of these characters were observed under open condition with mixture of soil, sand, poultry manure (1:1:1) and vermiwash @ 1 % of 30 DAB.

Among various bagging media, better nourishment of air layers of guava was found to be evident in the media with soil, sand, FYM, (1:1:1) proportion with vermiwash at 1 % with respect to rooting attributes like minimum number of days for sprouting, maximum number of sprouts, maximum number of leaves, shoots and survival percentage after 30 and 60 days of bagging. It was mainly due to combination of soil, sand and FYM has strong support for air layers early in the growth. Further vermiwash strengthen the air layers sprouting and survival. Venkatesan *et al.* (2010) also reported that bagging mixture of soil, sand, and Vermicompost (1:1:1) along with azospirullum significantly improved days to sprouting, length of sprout and number of leaves per plant. It was mainly due to combination of soil, sand and FYM has strong support for air layers early in the growth. Further vermiwash strengthen the air layers sprouting and survival. Venkatesan *et al.* (2010) also reported bagging mixture of soil, sand, and Vermicompost (1:1:1) along with azospirullum significantly improved days to sprouting, length of sprout and number of leaves per plant.

Shade net nursery conditions gave maximum survival percentage and growth parameters irrespective of treatments which might be due to the congenial micro-environmental conditions as compared to harsh and uncontrolled climatic conditions at open field nursery. This findings is in agreement with the results obtained by Ahmad *et al.* (2007) in patch budding of walnut, Singh *et al.* (2007) on wedge method of grafting in guava (*Psidium guajava*) cultivars Allahabad Safeda and Sardar under greenhouse condition, resulted in higher success than in an opened conditions. The positive effect of high organic matter and moisture retention capacity of FYM might have led to effective rooting of cuttings. Bashir *et al.* (2007); Das *et al.* 2006 also reported taller plant of sapota layers in media consisting of soil + FYM as one of the constituent. The high percentage of success of guava layers is possible when the environment was congenial for better survival. High success rate were obtained, when temperature are slightly high, relative humidity towards saturation, high sap flow and abundant oxygen (Hartmann and kester, 1972).

The results showed that nursery conditions had significant effect on establishments and biometric attributes of layered plants indicated in table 3. Among nursery conditions plants kept under shade net at 60 DAB resulted the highest survival percentage (78.17 %), minimum days to sprout appearance (12.62), maximum number of leaves (16.43) and (20.54) at 30 and 60 DAB and maximum number of shoots (4.58) and (5.06) at 30 and 60 DAB as compared to plant kept under open condition at 30 DAB. Among the bagging media, mixture of soil, sand, FYM (1:1:1) and vermiwash @ 1 % at 60 DAB were resulted the highest survival percentage (80.98%), minimum days to sprout appearance (12.20), maximum number of leaves (16.43) and (20.54) at 30 and 60 DAB and maximum number of shoots (4.59) and (5.10) at 30 and 60 DAB as compared to plant kept under open condition at 30 DAB.

The interaction effect between nursery conditions and rooting media had significant influence on establishments and growth parameters of plantlets layers presented in table 4. the highest establishment percentage (78.18 %), minimum days to sprout appearance (12.62), was observed under shade net at 60 DAB with mixture of soil, sand, FYM (1:1:1) and vermiwash @ 1 % and maximum number of leaves (16.43) and (20.54) at 30 and 60 DAB, maximum number of shoots (4.58) and (5.06) at 30 and 60 DAB was observed under shade net with mixture of soil, sand, FYM (1:1:1) and vermiwash @ 1 %. However, minimum value of these characters were observed under open condition with mixture of soil, sand, poultry manure (1:1:1) and vermiwash @ 1 % of 30 DAB. Shade net nursery conditions gave maximum establishment and bio metric attributes irrespective of treatments which might be due to the congenial micro-environmental conditions as compared to harsh and uncontrolled climatic conditions of open field nursery condition. This finding is in agreement with the results obtained by Ahmad *et al.* (2007) in patch budding of walnut, Singh *et al.,* (2007) on wedge method of grafting in guava (*Psidium guajava* L.)

cultivars Allahabad Safeda and Sardar under greenhouse obtained higher successes than in an opened conditions. The positive effect of high organic matter and moisture retention capacity of FYM might have led to effective rooting of cuttings. These results are in accordance with the findings of Das *et al.* (2006); Bashir *et al.* (2007) and reported increase in plant height of sapota layers in media consisting of soil + FYM as one of the constituent. The realization of high percentage of success of guava layers is possible when the environment performed congenial for rapid growth success. High success rate were obtained, when temperature are slightly high, relative humidity towards saturation, high sap flow and abundance of oxygen (Hartmann and Kester, 1972).

Table 1: Effect of nursery conditions and bagging media on rooting characters of plantlets layers at 60 days after bagging.

Factor	Primary roots	Longest primary roots	Diameter (mm) of primary roots	Secondary roots
E_1	34.28	8.81	1.61	58.52
E_2	39.60	10.35	1.67	70.63
CD (0.05)	1.69	0.12	0.02	3.72
M_1	38.42	10.00	1.83	69.64
M_2	39.65	10.29	1.87	72.06
M_3	38.35	9.90	1.72	69.23
M_4	31.33	8.13	1.14	47.36
CD (0.05)	1.69	0.50	0.08	2.89

E_1- Open condition, E_2- Shade net, M_1- Soil, Sand and FYM (1:1:1), M_2- Soil, Sand, FYM (1:1:1) and Vermiwash @ 1 %, M_3- Soil, Sand, Vermicompost (1:1:1) and Vermiwash @ 1 %, M_4- Soil, Sand, Poultry manure (1:1:1) and Vermiwash @ 1 %

Table 2: Interaction effect between nursery conditions and bagging media on rooting characters of plantlets layers at 60 days after bagging.

Factor	Primary roots	Longest primary roots	Diameter (mm) of primary roots	Secondary roots
E_1M_1	35.07	9.27	1.79	59.34
E_1M_2	37.26	9.78	1.81	67.03
E_1M_3	34.58	9.02	1.64	60.50
E_1M_4	30.21	7.19	1.04	47.21
E_2M_1	41.78	10.73	1.88	77.96
E_2M_2	42.12	10.81	1.93	79.94
E_2M_3	42.04	10.79	1.80	77.10
E_2M_4	32.44	9.07	1.24	47.50
CD (0.05)	2.94	0.20	0.03	6.44

E_1- Open condition, E_2- Shade net, M_1- Soil, Sand and FYM (1:1:1), M_2- Soil, Sand, FYM (1:1:1) and Vermiwash @ 1 %, M_3- Soil, Sand, Vermicompost (1:1:1) and Vermiwash @ 1 %, M_4- Soil, Sand, Poultry manure (1:1:1) and Vermiwash @ 1 %

Table 3: Effect of nursery conditions and bagging media on establishments and growth parameters of plantlets layers.

Factor	Establishments (%)	Days taken for sprouting	Number of leaves at		Number of shoots at	
			30 DAB	60 DAB	30 DAB	60 DAB
E_1	76.64	13.29	13.11	14.83	4.13	4.46
E_2	78.17	12.62	16.43	20.54	4.58	5.06
CD (0.05)	0.21	0.02	1.22	2.14	0.20	0.28
M_1	78.81	13.04	15.98	18.88	4.57	5.02
M_2	80.98	12.20	16.23	20.02	4.59	5.10
M_3	79.21	13.21	15.41	18.45	4.50	4.99
M_4	72.29	13.37	11.44	13.39	3.77	3.93
CD (0.05)	2.40	0.02	0.95	1.66	0.16	0.21

E_1- Open condition, E_2- Shade net, M_1- Soil, Sand and FYM (1:1:1), M_2- Soil, Sand, FYM (1:1:1) and Vermiwash @ 1 %, M_3- Soil, Sand, Vermicompost (1:1:1) and Vermiwash @ 1 %, M_4- Soil, Sand, Poultry manure (1:1:1) and Vermiwash @ 1 %

Table 4: Interaction effect of open filed and shade net nursery conditions of establishments and growth parameters of plantlets layers.

Factor	Establishments (%)	Days taken for sprouting	Number of leaves at		Number of shoots at	
			30 DAB	60 DAB	30 DAB	60 DAB
E_1M_1	77.74	13.37	14.83	15.30	4.30	4.66
E_1M_2	79.98	12.70	15.30	18.41	4.68	5.16
E_1M_3	78.91	14.05	13.72	13.77	4.15	4.56
E_1M_4	69.95	13.04	8.58	11.83	3.40	3.45
E_2M_1	79.88	12.70	17.14	22.46	4.83	5.38
E_2M_2	81.98	11.70	17.17	23.12	4.85	5.42
E_2M_3	79.51	12.37	17.11	21.63	4.51	5.04
E_2M_4	74.63	13.71	14.30	14.95	4.13	4.40
CD (0.05)	0.37	0.03	2.11	3.70	0.35	0.49

E_1- Open condition, E_2- Shade net, M_1- Soil, Sand and FYM (1:1:1), M_2- Soil, Sand, FYM (1:1:1) and Vermiwash @ 1 %, M_3- Soil, Sand, Vermicompost (1:1:1) and Vermiwash @ 1 %, M_4- Soil, Sand, Poultry manure (1:1:1) and Vermiwash @ 1 %

CONCLUSION

It can be concluded that among the nursery conditions *i.e.* shade net were found better for root characters, growth characters and survival percentage of rooted air layers cv. Allahabad Safeda and use of mixture of soil, sand, FYM (1:1:1) and vermiwash @ 1 % were found effective to enhance root characters, growth characters and survival percentage of rooted air layers as compared to other growing media.

Interaction of nursery condition and bagging media was significantly influenced rooted layers, growth and survival percentage at 60 Days after bagging (DAB).

FUTURE SCOPE

As layering does not involve sexual reproduction, newly developed plants become clones of the original plant and exhibit the same characteristics. Additionally, the new plant tends to be stronger and more mature than those propagated by any other technique. Layering process involves wounding the target region to expose the inner stem and optionally applying rooting medium. Layering results in a good-sized plant in a matter of weeks instead of years. Layering is utilized by horticulturists to propagate desirable plants. It has the advantage that the propagated portion continues to receive water and nutrients from the parent plant while it is forming roots. The newly developed plant has characteristics identical to the mother plant. Larger plants which are readily mature can be produced in faster time. Rooting success is more ensured through layering. The percentage of survival and survival of rooted layers in open field nursery conditions is very poor. Poly house technology has been in used better survival and performance of rooted layers, cutting plantlets. Polyhouse nursery condition is the alternative to an open nursery conditions.

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Conflict of Interest. None.

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