Original Research Article

Effects of plant growth regulators (IBA) and soil media on success, growth and survival of stem cutting of Assam Lemon (*Citrus lemon (L) Burm*).

ABSTRACT

An investigation was carried out to study of the " Effects of plant growth regulators (IBA) and soil media on success, growth and survival on rooting of stem cutting in Assam Lemon (*Citrus lemon (L) Burm*)." was successfully carried out in the year 2021-2022 in naturally polyhouse of experimental farm ,under (KVK),Central Agriculture University, Selesih, Aizawl, Mizoram. The experiment was carried out using Factorial Completely Randomized Design (FCRD) with replicated thrice. The cuttings were treated with five different doses of IBA and four different soil media and then planted in raised bed polyhouse. From the experiment, T5M2 (IBA 800ppm+Soil + Sand + vermicompost + Cocopeat (1:1:1:1)) was the best treatment in all the parameters for rooting of stem cutting in Assam lemon and over all the treatment gave the significant response in respect to all the parameters i.e. Date to first new leaf initiation (16.33), Number of leaf per plant (13.50), Plant height (21.43 cm), Shoot length (6.59 cm) , Stem diameter(2.37 cm) , Number of branches (6.08), Length of tap root (7.92 cm), Root spread (8.42 cm), Fresh weight of root (0.54 g), Dry weight of root(0.34 g), Survival percentage of cuttings (1.00), during the observation period in the foot hills of Mizoram.

Keywords: Assam lemon, stem cuttings, soil media, plant growth

1. INTRODUCTION

Lemon [Citrus limon (L.) Burm.] is one of the most popular fruits in citrus group in india and around the world as well. lemon is the leading acid citrus fruit and the third most favoured citrus species next to orange and mandarin, owing to its appealing color, aroma and flavor [1]. there are number of diverse form of lemon which may slightly differ from each other. it has wide adaptability which makes it one of the most promising fruit crops in the world. Assam lemon, an important variety of lemon is widely grown in the north-eastern parts of india which is a dwarf cultivar and suitable for high density planting [2]. Assam lemon is the most important lemon cultivar of Assam and other parts of n.e. region of India. it is locally

known as ‘kazi nemu’ in Assam, ‘pat nimboo’ in western India and ‘seville lemon’ in Andhra pradesh [3]. it is also found in the other north eastern states like Arunachal Pradesh, Nagaland and Meghalaya [4]. its inception is traced back to as chance seedling which was later propagated by vegetative means as a clonal variety and designated as Assam lemon [5].

It is an evergreen plant with dark green leaves; leaf lamina is lanceolate in shape having 70.2 mm in length and 30.2 mm in width with brevipetiolate attachment and dentate margin. leaf petiole is 8.6mm in length and its wings are absent. individual flowers are large, hermaphrodite and purple-tinged in the bud and on the lower surface of petals. anthers are also yellow in colour [2]. many flowers are staminate (sterile male) because of pistil abortion, the incidence of which varies greatly from bloom to bloom and season to season [6]. Assam lemon is found to be comparatively bigger in size than the normally grown lemon and hence, contain higher amount of juice. the fruit, zest, roots, leaves and juice are widely used in culinary, beverages, industries and medicines [7]. Assam lemon has the character of being able to bear fruits in many flushes making it available throughout the year with two peak season (February-March and September-October). it is a dwarf cultivar and suitable for high density planting [2]. this is a specific character of lemon which is not common in other citrus fruits. accordingly, to sustain the whole year fruiting and obtain the best quality fruits with maximum yield, it is necessary to maintain the nutrition status of the soil at peak level from where the plant receive nutrients. hence, proper application of fertilizers and manuring should be practiced to enhance the healthy and sturdy growth of plants on which the yield and quality fruit production solely depends. the fertilizers in combination from organic and inorganic nutrient sources would not only help to overcome the deficits of these vital nutrients in soil and plants, however, it would as well help in enhancing the integrated plant nutrient management program. to stipulate viable alternative solution for long term basis of sustainable plant nutrient system, verma and chauhan [8] in 2013 advocate that there is an urgent necessity to evaluate different nutrient systems being followed at present in fruit plants to mitigate nutritional deficiencies along with appropriate combination of urea, single super phosphate, muriate of potash, vermicompost and farm yard manure which will eventually help in fulfilling nutrition needs of the tree for economically profitable production of citrus fruit. thus, the optimized standards of fertilizer application are of great importance to get good growth. therefore, the present study were undertaken to find out the best possible combination of organic and inorganic fertilizers which can stimulate the citrus production without adversely affecting the quality of soils.

2. MATERIAL AND METHODS

A field experiment was conducted at Krishi Vigyan Kedra(KVK), Central Agriculture University, Selesih, Aizawl, Mizoram during the year 2021. The experiment was started in September 17, 2021

The experiment material consists of assam Lemon (Citrus lemon (L) burm). The experiment was laid out in two Factorial Completely Randomized Design(FCRD) with three replications and twenty treatments and the treatment consisted of two factors i.e. five levels of IBA(100ppm,20ppm,400ppm,600ppm,800ppm)Factor ‘A’ and four levels of soil media (Soil + Sand + FYM + Cocopeat (1:1:1:1), Soil + Sand + vermicompost+ Cocopeat (1:1:1:1), Soil + Sand + FYM + Trichiderma + Cocopeat + Azotobacter, Soil + Sand + vermicompost+ Trichoderma + Cocopeat+ Azotobacter)Factor ‘B’. Treatment details were given below:

Factor A

Level of IBA

- T_1 : IBA 100 ppm
- T_2 : IBA 200 ppm
- T_3 : IBA 400 ppm
- T_4 : IBA 600 ppm
- T_5 : IBA 800 ppm

Factor B

Soil Media

- M_1 : Soil + Sand + FYM + Cocopeat (1:1:1:1)
- M_2 : Soil + Sand + vermicompost+ Cocopeat (1:1:1:1)
- M_3 : Soil + Sand + FYM + Trichiderma + Cocopeat + Azotobacter
- M_4 : Soil + Sand + vermicompost+ Trichoderma + Cocopeat+ Azotobacter

The total number of polybag is 240(20 treatments x 3 replication x 4 units), number of cuttings per bag is 1 and polybag dimention is 10x14"cmsize black polybag, the polybags is 2kg quantity were used. In the bottom of poly bags 3-4 holes were made to ensure drainage. According to treatments, rooting media were prepared by thoroughly mixing of garden soil, sand, FYM ,vermicompost, cocopeat, trichoderma, and azotobacter. It was sterilized by solarization method during hot summer months. Well mixed media were filled in poly bags. The prepared cuttings were treated with different doses of IBA solution and planted in the polybags in shade house. Irrigation channels were prepared according to layout.

Different levels of indole 3butyric acid (IBA) of 100 ppm(T_1) , 200ppm(T_2), 400ppm(T_3) , 600ppm (T_4), 800ppm (T_5) solution were used. To prepare PGR solution, required quantity of IBA 3ml was dissolved in 20ml of absolute alcohol and stirred thoroughly until the power get dissolved completely. Latter the final volume was made up to1 liter by adding distilled water.

The cuttings were made in 18-21cm in length. The cutting were obtained from 1 year old shoot of 5-6 years old mother plant of Assam lemon. 20 cutting were treated in each replication and total 60 cutting were planted in each treatment. Therefore, total 240 cuttings were used for rooting of cuttings.

The prepared cuttings were ready for treatment and planting. One third basal portion of the cutting were dipped 20-30 minutes in aquaceous solution of IBA according to concentration and planted in the polythene bags by inserting two-third portion in poly bags. The planted cuttings were irrigated regularly depending upon soil moisture conditions.

3. RESULTS AND DISCUSSION

The data present in table 1. with regards to growth parameters showed days taken to Date to first new leaf initiation, Number of leaf per plant , Plant height(cm), Shoot length (cm) , Stem diameter(cm) , Number of branches, Length of tap root (cm), Root spread (cm), Fresh weight of root(g), Dry weight of root(g), Survival percentage of cuttings

The significantly minimum number of days required was observed in T5M2 (IBA 800 ppm+Soil + Sand + vermicompost + Cocopeat) with 18.31 and 26.63 days, followed by T4M3 (IBA 600 ppm+ Soil + Sand + FYM + Trichoderma + Cocopeat+ AZB) with 23.87 and 28.00 days. More number of days was taken by treatment T2M1 (IBA 200 ppm +Soil + Sand + FYM + Cocopeat (1:1:1:1) with 35.92 and 31.12 days

The highest number of leaves was observed in treatment T5M2(IBA 800 ppm+Soil + Sand + vermicompost+ Cocopeat (1:1:1:1) with 12.19 and 11.43 which was followed by T2M4 (IBA 200 ppm+Soil + Sand + vermicompost+ Trchoderma + Cocopeat+ AZB) with 11.29 and 11.38 and minimum number of leaves was observed in T1M1(IBA 100 ppm+Soil + Sand + FYM + Cocopeat (1:1:1:1) with 10.46 and 10.67.

Plant height was found in significant. T5M2 (800 ppm+Soil + Sand + vermicompost+ Cocopeat (1:1:1:1) with 19.48 and 19.35cm which was followed by T3M4 (IBA400 ppm+Soil + Sand + vermicompost+ Trchoderma + Cocopeat+ AZB).And the minimum was recorded in T1M3(IBA100 ppm+Soil + Sand + FYM + Trchiderma + Cocopeat + AZB)

The maximum length of shoot was observed in treatment T5M2 (IBA800 ppm+Soil + Sand + vermicompost+ Cocopeat (1:1:1:1) with 4.75 and 6.59 cm, followed by T3M3(IBA400 ppm+Soil + Sand +

FYM + Trchiderma + Cocopeat + AZB with 4.42 and 4.86. The minimum length of shoot was observed in treatment T1M1(IBA100 ppm+ Soil + Sand + FYM + Cocopeat (1:1:1:1)

The diameter of stem was (cm) was significantly differed in all the applied treatments. The maximum was recorded in treatment T5M2 (IBA800 ppm+Soil + Sand + vermicompost+ Cocopeat (1:1:1:1) with 1.51 and 1.57 followed by T1T4M1 with 1.32 IBA100 ppm,600 ppm+Soil + Sand + FYM + Cocopeat (1:1:1:1), while the minimum diameter was observed in T2M3 IBA200 ppm+Soil + Sand + FYM + Trchiderma + Cocopeat + AZB

The number of branches was significantly differed in all the applied treatments. The maximum was recorded in treatment T5M2 (IBA800 ppm+Soil + Sand + vermicompost+ Cocopeat (1:1:1:1) with 4.96 and 4.52 followed by T4M2 with 3.96 and 4.52,IBA600 ppm Soil + Sand + vermicompost+ Cocopeat (1:1:1:1) while the minimum diameter was observed in T2M3 IBA200 ppm+Soil + Sand + FYM + Trchiderma + Cocopeat + AZB .The minimum was observed in T3M3 IBA 400 ppm+Soil + Sand + FYM + Trchiderma + Cocopeat + AZB

The maximum length of tap root T5M4 (6.16 and 5.69 cm) with an application dose of IBA800 ppm+Soil + Sand + vermicompost+ Trchoderma + Cocopeat+ AZB, which was followed by T4M3 (5.42 and 5.26 cm) dose of IBA600 ppm+Soil + Sand + FYM + Trchiderma + Cocopeat + AZB and the minimum was observed in T3M1 (4.82 and 4.96 cm) IBA400 ppm+Soil + Sand + FYM + Cocopeat (1:1:1:1)

The maximum number of root spread (7.00 and 7.03) was recorded with an application of T5M2 IBA800 ppm+Soil + Sand + vermicompost+ Cocopeat (1:1:1:1) followed by T3M4 IBA400 ppm+Soil + Sand + vermicompost+ Trchoderma + Cocopeat+ AZB with (6.50 and 6.16) and the minimum was found in T1M1 IBA100 ppm+Soil + Sand + FYM + Cocopeat (1:1:1:1) with (5.00 and 5.88).

The highest fresh weight of roots was recorded in case of treatment T5M2 IBA800 ppm+Soil + Sand + vermicompost+ Cocopeat (1:1:1:1) with 0.48 and 0.45 g.And the minimum fesh weight of root (0.40 and 0.43) was observed in T1M1 IBA100 ppm+Soil + Sand + FYM + Cocopeat (1:1:1:1)

The highest dry weight of roots was recorded in case of treatment T5M1M2 IBA800 ppm+Soil + Sand + vermicompost+ Cocopeat (1:1:1:1)andSoil + Sand + vermicompost+ Cocopeat (1:1:1:1) with 0.28 and 0.26 g. And the minimum dry weight of root (0.24 and 0.23) was observed in T1T2T4M4 IBA100,200 and 600 ppm+Soil + Sand + FYM + Cocopeat (1:1:1:1)

The maximum survival percentage (0.96 and 0.78) was recorded with the dose of T5M4 IBA800 ppm+Soil + Sand + vermicompost+ Trchoderma + Cocopeat+ AZB. Followed by (0.77) with the dose of T3T4M2 IBA400,600 ppm+Soil + Sand + vermicompost+ Cocopeat (1:1:1:1). Therefore, the minimum survival percentageT1M1IBA100ppm+Soil+Sand+FYM+Cocopeat(1:1:1:1)

Table 1. Effects of plant growth regulators (IBA) and soil media on growth of Assam Lemon

Treatment	Date to first new leaf	No of leaf per plant	Plant height	Shoot length	Stem diameter	No of branches	Length of tap root	Root spread	Fresh weight of root	Dry weight of root	Survival %
T1(100ppm)	32.44	10.46	18.62	3.92	1.32	3.94	5.05	5.00	0.40	0.24	0.29
T2(200ppm)	35.92	11.29	18.72	4.31	1.28	3.92	4.99	6.44	0.42	0.24	0.46
T3(400ppm)	31.85	10.83	19.06	4.42	1.32	3.83	4.82	6.50	0.44	0.25	0.77
T4(600ppm)	23.87	11.00	19.03	4.27	1.32	3.96	5.42	6.42	0.45	0.24	0.77
T5(800ppm)	18.31	12.19	19.48	4.75	1.51	4.96	6.16	7.00	0.48	0.28	0.96
M1(soil+sand+FYM+Cocopeat)	31.12	10.67	18.84	4.15	1.32	3.93	4.96	5.88	0.43	0.26	0.45
M2(soil+sand+vermicompost+cocopeat)	26.63	11.43	19.35	4.58	1.57	4.52	5.24	7.03	0.45	0.26	0.70
M3(soil+sand+FYM+trichoderma+cocopeat+AZB	28.00	11.13	18.62	4.19	1.28	3.87	5.26	6.02	0.44	0.25	0.67
M4(soil+sand+vermicompost+trichoderma+cocopeat+AZB)	28.17	11.38	19.11	4.42	1.30	4.17	5.69	6.16	0.44	0.23	0.78
SEd(±)	2.09	0.36	0.28	0.26	0.12	0.34	0.36	0.69	0.007	0.014	0.07
CD at 5%	5.78	1.03	0.70	0.74	0.33	0.96	1.02	1.97	0.02	0.04	0.19

4. CONCLUSION

In accordance of the results summarized above, it can be concluded that the treatment T5M2 (800 ppm IBA)+ soil + sand + cocopeat + vermicompost (1:1:1:1) was found to be best for rooting of stem cuttings and survival percentage of Assam lemon (*citrus limon* l burm). over all, the treatment T5M2 (800 ppm iba) gave the significant response in respect to all the parameters recorded i.e., days taken to date to first new leaf initiation, number of leaf per plant , plant height(cm), shoot length (cm) , stem diameter(cm) , number of branches, length of tap root (cm), root spread (cm), fresh weight of root(g), dry weight of root(g), survival percentage of cuttings

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