

Effect of Different Levels of Indole-3-butyric acid on Growth, Development, Survival and Establishment of Air Layered Lemon (*Citrus limon* L. Burm.) Cv. Assam Lemon under Allahabad Agro-climatic Condition

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ABSTRACT- An experiment entitled “Effect of different levels of indole-3-butyric acid (IBA) on growth, development, survival and establishment of air layered lemon *Citrus limon* (L. Burm.) cv. Assam lemon under Allahabad agro-climatic condition” was undertaken at Department of Horticulture, SHIATS, Allahabad during the year 2014-2015. The experiment was laid out in Completely Randomised Design (CRD) with ten treatments and replicated thrice. The partially rooted air layered were treated with different concentration containing 0, 1000, 1250, 1750, 2000, 2250, 2500, 2750 and 3000 ppm IBA solution by quick dip method. The result of the investigation indicated that, the application of IBA 2000 ppm produces the highest no. of bud initiation (17.33), no. of leaves (107.33), leaf area (38.37cm²), no. of branches (6.33), length of branches (106.33 cm), and canopy of plants (73.33 cm). Among the treatments no. of bud initiation; T₁ IBA@1000ppm (14.67), no. of leaves; T₉ IBA@3000ppm (53.67), leaf area; T₁ IBA@1000ppm (25.03cm²), no. of branches; T₁ IBA@1000ppm (3.67), length of branches; T₉ IBA@3000ppm (53.67 cm), and canopy of plants; T₁ IBA@1000ppm (39.00cm) are the least effective. However all the treatments were superior over control i.e. no. of bud initiation (13.67), no. of leaves (51.67), leaf area (21.99cm²), length of branches (43.33cm), no. of branches (2.67) and canopy of plants (29.08cm). Highest survival and establishment percentage were also observed in T₅ IBA@ 2000 ppm 73.58% and 90.00% respectively. It was also observed that application of irrigation water at 7 days interval during the month of December to April is required.

Key-words- Indole-3-butyric acid, Survival, Canopy, *Citrus limon*, CRD

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INTRODUCTION

Citrus fruits are one of the major fruit crops of the world. It is one of the choicest fruit having high consumer's preference both as fresh and as well as its processed juice. Citrus possess greater genetic variability and adaptability compare to other fruit crops.

Internationally citrus plantation in the world is confined to 0-40° latitude from north to south of the equator covering different regions having different soil and climatic conditions [1].

India is a country with a vast genetic diversity of *Citrus species*, a large number of *Citrus species* or progenitors of commercially important *Citrus species* are found in India. North eastern hill (NEH) region of India is considered to be natural home of many *Citrus species*. Many of the species are wild. Among the *Citrus species* found in north eastern India *Citrus limon* is one of the important species. *Citrus limon* cv. Assam lemon is the principal lemon cultivar of the north eastern region of India. It was originated in Assam. Fruit is medium large, long elliptic to oblong-obovate, base rounded, nipple broad but low, rind

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medium-thick, firm, surface very smooth, shinning, colour greenish yellow, segments 9-12, axis hollow, pulp vesicle crystal white, juice abundant, acidic, fruit weight (g) 81.33, Peel thickness (mm) 1.73, No. of segment 1 0.67, Seeds/fruit 1.00, TSS 7.33, acidity (%) 7.90, flavor good, usually seedless, occasionally contains a few seeds. This cultivar is prolific bearer and is one of the best lemon variety found in India.

Air-layering has been practised for long in tropical and sub-tropical area as it is comparatively simple and success is high in humid climate. The most common method of vegetative propagation of Assam lemon is air layering. Layering involves the regeneration of adventitious roots from a shoot when it is still attached with the mother plant. Root initiation is stimulated by girdling. Elimination of light from the part of the stem where roots are to develop is the feature common to all layering. Exogenous application of auxins has been found to hasten the initiation of roots, increase percentage of rooting and number of roots per layer [2].

Citrus limon cv. Assam lemon was not cultivated in north Indian region. Assam lemon is a citrus variety possessing good quality for juice processing and table purpose, and so the study of growth, development, survival and establishment of this cultivar under Allahabad agro-climatic condition is the major objective of this research.

MATERIALS AND METHODS

The experiment was carried out inside the net-house of the Department of Horticulture, Sam Higginbottom Institute of Agriculture Technology & Sciences, Deemed-to-be University, Allahabad, Uttar Pradesh, India during the year 2014-2015. The different treatments were manipulated as follows; T₁-IBA@1000ppm; T₂-IBA@1250ppm, T₃-IBA@1500ppm, T₄-IBA@1750ppm, T₅-IBA@2000ppm, T₆-IBA@2250ppm, T₇-IBA@2500ppm, T₈-IBA@2700ppm, T₉-IBA@3000ppm, T₁₀-distilled water. The treatments were arranged in a completely randomized design with ten treatments each replicated thrice. Partially rooted air layered plants were planted in an earthen pot. Different levels of IBA were treated by quick dip method. Observations for different parameters were recorded at an interval of 30 days.

The planting materials were brought from Mizoram through the reputed nursery men. No chemicals were used by the nursery men during the process of air layering.

RESULTS AND DISCUSSION

Number of bud initiation per plant

The maximum number of bud initiation for 30 DAP was found in treatment T₅ IBA@2000ppm, which exhibited significant increase in the number of bud initiation (5.67) over control and other treatments, followed by T₆ IBA@2250ppm (4.67), T₄ IBA@1750ppm (4.33) respectively. Significantly minimum number of bud initiation was observed in treatment control T₁₀ (1.33).

A similar trend was further noticed at 150 DAP, maximum

number of bud initiation was found in treatment T₅ IBA@2000ppm (17.33) which was followed by T₆ IBA@2250ppm (17.00) and the minimum number of bud initiation in treatment T₁₀ control (13.67). A similar result was observed by Gohil [3] in cashew nut.

Number of leaves

The maximum number of leaves for 30 DAP was observed in treatment; T₅ IBA@2000ppm and produced significantly more number of leaves per plant (29.33), which was statistically superior over control and all other remaining treatments under study. It was followed by T₆ IBA@2250ppm (22.00) which was statistically at par with the treatment T₇ IBA@2500ppm (19.00), T₄ IBA@1750ppm (17.33). The minimum number of leaves per plant was obtained under the treatment control (6.33).

At 150 DAP the maximum number of leaves per plant was produced by the treatment T₅ IBA@2000ppm (73.33) which was statistically superior over all other remaining treatments under study. The treatments T₆ IBA@2250ppm and T₄ IBA@1750ppm produced 66.71 and 62.17 number of leaves per plant respectively. The minimum number of leaves per plant was observed under the treatment control (29.08).

Similar findings were reported by Jan [4] in litchi and Singh [5] in lemon cv. Pant lemon.

Number of branches

The maximum number of branches for 30 DAP was observed in treatment T₅ IBA@2000ppm (4.67) which was followed by T₆ IBA@2250ppm (4.33) and the minimum number of branches in treatment T₁₀ control (1.33).

At 150 DAP maximum number of branch was observed in treatment T₅ IBA@2000ppm (6.33) which was followed by T₆ IBA@2250ppm (6.00) and the minimum number of branches in treatment T₁₀ control (2.67).

These results are in accordance with the findings of Tomar [6] in pomegranate.

Length of branches

The maximum length of branches for 30 DAP was observed in the treatment T₅ IBA@2000ppm produced significantly higher length of branches per plant (15.23cm), which was statistically superior over control and all other remaining treatments under study. It was followed by T₆ IBA@2250ppm (13.18cm) which was statistically at par with the treatment T₄ IBA@1750ppm (12.83cm), T₇ IBA@2500ppm (12.67cm). The minimum length of branches per plant was obtained under the treatment control (7.90cm). A similar trend was observed in 150 DAP, the maximum length of branches per plant was produced by the treatment T₅ IBA@2000ppm (106.33cm) which was statistically superior over all other remaining treatments under study. The treatments T₆ IBA@2250ppm and T₄ IBA@1750ppm produced 99.67cm and 87.67cm length of branches per plant respectively. The minimum length of branches per plant was observed under the treatment

control (43.33cm).

A similar finding was reported by Singh [7] in lemon cv. Pant lemon.

Canopy spread

The canopy spread of plants for 30 DAP has been found that the treatment combinations has significant effect on the canopy spread of the plants, T₅ IBA@2000ppm exhibited significant increase in the spread of canopy (33.08cm) over control and other treatments, followed by T₆ IBA@2250ppm (28.70cm), T₄ IBA@1750ppm (25.66cm) respectively. Minimum spread of canopy per plant was observed in treatment control T₁₀ (13.86cm).

The maximum canopy of plants for 150 DAP was recorded in the treatment T₅ IBA@2000ppm (73.33cm) followed by the treatment T₆ IBA@2250ppm (66.71cm) and treatment T₄ IBA@1750ppm (62.17cm) and T₃ IBA@ 1500ppm (55.44cm) were statistically similar with each other. Control recorded minimum spread of canopy per plant (29.08cm).

These results are in accordance with the findings of Tomar [8] in kagzi lime.

Leaf area of plants

Data on average leaf area of plant reveals that, at 75 day after planting, it has been found that the treatment combinations showed significant effect on the leaf area of plant. T₅ IBA@2000ppm exhibited significant increase in the leaf area of plant (24.40cm²) over control and other treatments, followed by T₆ IBA@2250ppm (20.15cm²), T₄

IBA@1750ppm (18.08cm²) respectively. Minimum leaf area of plant was observed in treatment control T₁₀ (10.67cm²).

At 150 days after planting, significant effects on different treatment level were observed. Maximum leaf area of plant was observed in the treatment T₅ IBA@2000ppm (38.37cm²) which was followed by treatment T₆ IBA@2250ppm (36.08cm²), T₄ IBA@1750ppm (32.82cm²) respectively. The minimum leaf area of plant was observed in treatment control T₁₀ (21.99cm²).

In contrast to these results, Mankar [9] opined that the IBA @ 3000 ppm increased to leaf area of plants.

Survival percentage

The highest survival percentage was observed in treatment T₅ IBA@2000ppm (73.58%) which was followed by T₆ IBA@2250ppm (65%) and the minimum survival percentage of plants in treatment T₁₀ control (40.4).

These results are in accordance with the findings of Tomar [10] in pomegranate.

Establishment percentage

The highest establishment percentage was observed in treatment T₅ IBA@2000ppm (90%) which was followed by T₆ IBA@2250ppm (71.56%) and the minimum establishment percentage in treatment T₁₀ control (50.77%). A similar finding was reported by Ghosh [11] in sweet orange.

Table 1: Response of IBA on growth, development, survival and establishment of Assam lemon

Treatments	No. of bud initiation	No. of leaves per plant	No. of branches per plant	Length of branches per plant (cm)	Canopy spread of plants (cm)	Leaf area of plants (cm ²)	Survival percentage	Establishment percentage
T ₁ IBA@ 1000ppm	14.67	55.33	3.67	57.00	39.00	25.03	45.00	65.65
T ₂ IBA@ 1250ppm	15.00	85.00	4.00	77.67	50.28	28.08	45.00	65.65
T ₃ IBA@ 1500ppm	16.33	99.00	5.33	82.00	55.49	30.45	54.93	68.86
T ₄ IBA@ 1750ppm	16.33	105.67	5.33	87.67	62.17	32.82	60.00	70.63
T ₅ IBA@ 2000ppm	17.33	107.33	6.33	106.33	73.33	38.37	73.58	90.00
T ₆ IBA@ 2250ppm	17.00	101.00	6.00	99.67	66.71	36.08	65.65	71.56
T ₇ IBA@ 2500ppm	15.33	76.67	4.33	77.34	55.07	30.08	60.00	70.63
T ₈ IBA@ 2750ppm	15.00	76.00	4.00	70.00	47.97	27.26	49.60	68.02
T ₉ IBA@ 3000ppm	15.00	53.33	4.00	53.67	42.33	25.26	45.00	65.65
T ₁₀ (control)	13.67	51.67	2.67	43.33	29.08	21.99	40.40	50.77
F- test	S	S	S	S	S	S	S	S

S. Ed. (±)	0.63	1.20	0.67	1.27	0.80	0.88	1.70	0.67
C. D. (P=0.05)	1.52	2.90	1.42	3.02	1.93	2.14	4.11	1.62

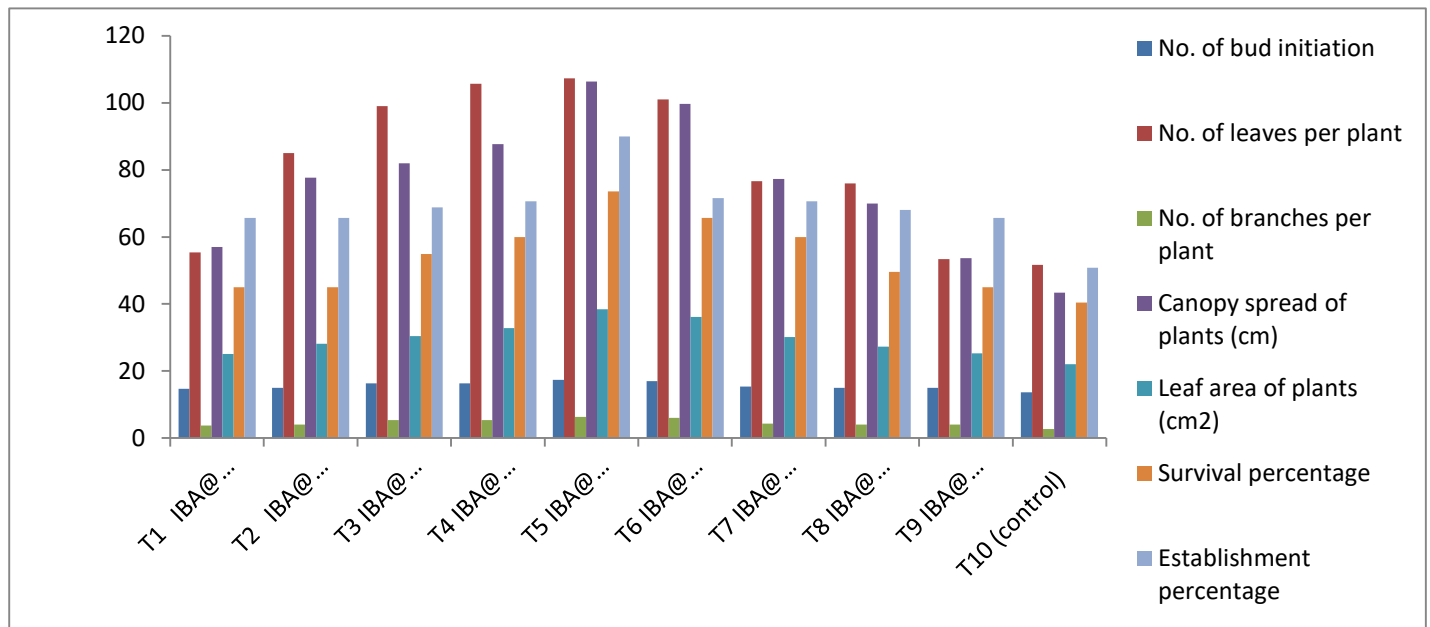


Fig. 1: Response of IBA on growth, development, survival and establishment of Assam lemon

CONCLUSIONS

On the basis of present investigation it can be concluded that treatment T₅ IBA@ 2000 ppm was found best in terms of no. of bud initiation (17.33), no. of leaves (73.33), leaf area (38.37cm²), no. of branches (6.33), length of branches (106.33 cm), canopy of plants (33.08cm²s), survival percentage (73.58) and establishment percentage (90). A further experiment is suggested to confirm the consistency of results.

Citrus limon cv. Assam lemon can be successfully cultivated under Allahabad agro-climatic conditions provided regular irrigation should be supply during the dry period at 7 days interval to maintain the vigor and survival and establishment of the plants.

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