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INFLUENCE OF BIO-REGULATORS AND AIR-LAYERING SEASON ON THE PROPAGATION EFFICIENCY OF JACKFRUIT (*ARTOCARPUS HETEROPHYLLUS* LAM.)

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ABSTRACT

Studies was conducted to find out the effect of various concentrations of IBA (2000, 4000 and 6000 ppm) and four times of air-layering operations (10 July, 20 July, 10 August, 10 September) on the rootability in jackfruit through air-layering. A critical study of present findings show that the treatment of C_3 (6000 ppm IBA) was found to produce highest percentage of rooted layers (82.00%), length of the longest root (15.50 cm), diameter of thickest root (1.73 mm), number of primary and secondary roots (52.33), minimum days to rooting (33.33), maximum fresh weight of root (0.98 g), dry weight of root (0.47 g), length of the new growth (3.51 cm). In case of planting time, the treatment of T_2 (20 July) planting time was found to produce highest percentage of rooted layers (80.66 %), length of the longest root (19.92 cm), diameter of thickest root (1.70 mm), number of primary and secondary roots (51.33), minimum days to rooting (33.66), maximum fresh weight of root (0.96 g), dry weight of root (0.46 g) and length of the new growth (3.33 cm).

Key words : Jackfruit, IBA, Planting time, Air-layering, Rooting.

Introduction

Jackfruit (*Artocarpus heterophyllus* Lam.) is a tropical evergreen tree belonging to the Moraceae family, widely cultivated in South and Southeast Asia for its nutritious fruit, timber and multiple economic benefits. It is known for producing the world's largest fruit, which is highly valued for its rich taste, medicinal properties, and diverse culinary applications. Due to its adaptability to a range of climatic conditions and its economic significance, the demand for high-quality jackfruit planting materials has increased significantly in recent years. However, the slow and inconsistent propagation of jackfruit through conventional methods presents a major challenge to its large-scale cultivation (Ocloo *et al.*, 2010).

Jackfruit is commonly propagated through seeds, but this method results in genetic variability due to its cross-pollinating nature, leading to significant variations in fruit quality, yield, and other desirable traits. Moreover, seed propagation has limitations such as a long juvenile phase and poor seed viability over time. Vegetative propagation techniques, such as grafting, budding and air-layering, are often used to maintain genetic uniformity and enhance plant establishment. Among these, air-layering (marcotting) is considered one of the most effective methods for producing true-to-type planting materials while ensuring early fruiting and uniform characteristics (Tomar, 2011). However, the success of air-layering in jackfruit is influenced by several factors, including the physiological state of the plant, environmental conditions, and the use of bio-regulators (Singh, 2002).

Bio-regulators, also known as plant growth regulators (PGRs), play a crucial role in improving the rooting success of air-layered plants. Auxins such as Indole-3-Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) are commonly used to stimulate root initiation, enhance root development and increase survival rates of propagated plants. These bio-regulators help overcome the natural resistance of woody plants to rooting, improving the efficiency of vegetative propagation techniques. Various studies have demonstrated the effectiveness of auxins in increasing root length, root number and overall plant vigor in different fruit crops, including jackfruit. However, the optimal concentration and combination of bio-regulators for successful air-layering in jackfruit require further investigation (Singh *et al*., 2011; Singh *et al*., 2014; Singh *et al*., 2019).

Another important factor influencing the success of air-layering is the timing of propagation. Seasonal variations significantly affect the physiological and biochemical responses of plants, impacting root formation and survival rates. Environmental factors such as temperature, humidity and rainfall play a crucial role in determining the success of air-layering. Research suggests that air-layering performed during the active growth phase of the plant, usually in the monsoon or early post-monsoon period, tends to yield better results compared to other seasons. However, the most suitable time for air-layering in jackfruit varies across different climatic regions and requires precise evaluation (Saroj *et al*., 2020; Rawar *et al*., 2014; Singh *et al*., 2016; Satpal *et al*., 2014).

Given the increasing demand for quality planting materials and the limitations of seed propagation, optimizing air-layering techniques using bio-regulators and selecting the best time for propagation can significantly improve the multiplication rate of jackfruit. This study aims to evaluate the effect of different bio-regulators and seasonal timing on the propagation efficiency of jackfruit through air-layering. The findings will provide valuable insights for nursery growers and farmers to enhance the success rate of jackfruit propagation, ensuring sustainable production and improved fruit quality. The amount of time required for root emergence, the quantity of adventitious roots, the thickness, and the length of roots in air layers are dependent on the rooting media and wrapping materials (Alam *et al*., 2004).

Materials and Methods

The experiment consists of 16 treatment combinations of IBA having four concentrations *i.e.*; 2000, 4000 and 6000 ppm and 0 ppm at four times of air-layering operations *i.e.*; 10 July, 20 July, 10 August, 10 September. Two years old well developed healthy shoots of light brown colour were selected for air-layering. The approximate lengths of the selected shoots were 35 cm. with a diameter of 1 cm. A ring of bark of about 2.5 cm. was removed from the branch. The upper cut in the bark was given just below the bud and applied with different concentrations of bio-regulators. Thereafter it was covered with the moist Sphagnum moss and wrapped with transparent polythene sheet. The polythene was tied firmly at both the ends with strong jute strings in order to make airtight. Two months after air-layering, rooted layers were detached from the mother plant and planted in well prepared nursery beds under partial shade, after removing the polythene sheet used for layering, without disturbing the roots. Most of the leaves from the layers were removed to minimize the transpiration. The irrigation was done immediately after planting. The observations of rooting and survival performance were recorded regularly at 10 days intervals and experiment was laid-out in FRBD design with three replications.

Results and Discussion

A critical study of present findings show that the treatment of 6000 ppm concentration of IBA was found to produce highest percentage of rooted layers (82.00%), maximum length of the longest root (15.50 cm), maximum diameter of thickest root (1.73 mm), maximum number of primary and secondary roots (52.33), minimum days to rooting (33.33), maximum fresh weight of root (0.98 g), maximum dry weight of root (0.47 g), maximum length of the new growth (3.51 cm), while the minimum percentage of rooted layers (53.33%), minimum length of the longest root (9.66 cm), minimum diameter of thickest root (1.10 mm), minimum number of primary and secondary roots (33.66), maximum days to rooting (45.33), minimum fresh weight of root (0.69 g), minimum dry weight of root (0.47 g), minimum length of the new growth (1.52 cm) was observed under C0 (Control) treatments. According to Rymbai and Reddy (2010), this outcome might be related to the use of indole-3-butyric acid, which may promote the movement of photosynthates from the leaves to the root developing zone. This would help air-layered jackfruit plants grow and develop and yield high-quality planting materials. According to Tomar (2011), layering jackfruit in July produced a higher percentage of rooted air layers and a maximum survival rate when IBA @ 10,000 ppm was used. According to Khandaker *et al*. (2022), applying IBA with rooting media

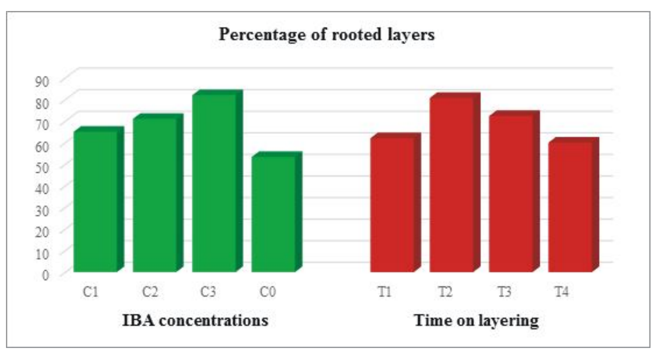

Fig. 1 : Effect of different IBA concentrations and time of layering on rooting success and root growth in air-layering of jackfruit.

enhanced the growth of adventitious roots, raised the amount of chlorophyll in leaves, boosted vegetative growth and improved the survival rate of wax apple air layers. Desai and Patel (1984) and Dhua and Sen (1984) have supported the similar findings while Singh and Singh (2004) reported that the combination of IBA + NAA at 5000 ppm each showed the best effect on the rooting of the air layers of jackfruit.

In case of planting time, the treatment of T_2 (20 July) planting time was found to produce highest percentage of rooted layers (80.66%), maximum length of the longest root (19.92 cm), maximum diameter of thickest root (1.70 mm), maximum number of primary and secondary roots (51.33), minimum days to rooting (33.66), maximum fresh weight of root (0.96 g), maximum dry weight of root (0.46 g), maximum length of the new growth (3.33 cm), while the minimum percentage of rooted layers (60.00%), minimum length of the longest root (12.23 cm), minimum diameter of thickest root (1.23 mm), minimum number of primary and secondary roots (32.66), maximum days to rooting (39.33), minimum fresh weight of root (0.73 g), minimum dry weight of root (0.21 g), minimum length of the new growth (1.78 cm) was observed under T_4 (10 September) planting time. Because adequate soil moisture, humidity and ideal temperature are necessary for the highest survival of the detached air-layers, Bose *et al*. (1986) found that the time of layering and layer detachment from the mother plants is the most important factor for rooting success. Therefore, for jackfruit, it is also advised to propagate at the proper time to maximize the survival of the detached air layers. It may be due to a particular correlation of temperature, humidity and rainfall. Singh *et al*. (2016) in guava, Maurya *et al*. (2012) in guava have reported similar observations. The longer duration of a good season for developing the layer in the soil following preparation is an additional benefit for layers prepared during these months. Hormonal imbalance and the lack of uniform rooting material are the primary causes of the low reported percentage of rooted layer establishment and survival (Singh, 2002).

Conclusion

According to a thorough investigation of the

Table 1: Effect of different IBA concentrations on rooting success and root growth in air-layering of jackfruit.

Treatments	Percentage of rooted layers	Length of the longest root (cm)	Diameter of thickest root (mm)	Number of primary and secondary roots	Days to Rooting	Fresh weight of root (g.)	Dry weight of root (g.)	Length of the new growth (cm)
C_1 (2000 ppm IBA)	65.00	12.60	1.43	46.33	39.33	0.82	0.36	2.52
C_2 (4000 ppm IBA)	71.00	13.90	1.53	47.00	35.66	0.90	0.45	2.95
C_3 (6000 ppm IBA)	82.00	15.50	1.73	52.33	33.33	0.98	0.47	3.51
C_0 (Control)	53.33	9.66	1.10	33.66	45.33	0.69	0.22	1.52
C.D.	5.126	1.060	0.176	2.008	1.176	0.045	0.010	0.200
S.Em.	1.453	0.300	0.050	0.569	0.333	0.013	0.003	0.057

Table 2: Effect of different Time on layering success and root growth in air-layering of jackfruit

Treatments	Percentage of rooted layers	Length of the longest root (cm)	Diameter of thickest root (mm)	Number of primary and secondary roots	Days to Rooting	Fresh weight of root (g.)	Dry weight of root (g.)	Length of the new growth (cm)
T_1 (10 July)	62.00	12.50	1.50	47.66	36.66	0.94	0.43	2.68
T_2 (20 July)	80.66	14.92	1.70	51.33	33.66	0.96	0.46	3.33
T_3 (10 August)	72.33	13.50	1.33	43.33	38.33	0.78	0.34	2.22
T_4 (10 September)	60.00	12.23	1.23	32.66	39.33	0.73	0.21	1.78
C.D.	3.973	0.903	0.148	0.898	1.358	0.015	0.019	0.543
S.Em	1.126	0.256	0.042	0.255	0.385	0.004	0.006	0.154

above results, the most effective methods for increasing the percentage of rooted layers and increasing survival rates in jackfruit propagation by air-layering were treating with 6000 ppm of IBA and layering in July month.

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