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Influence of propagation methods and indole butyric acid (IBA) concentrations on root development of *Intsia bijuga* (Colebr.) O. Kuntze serial cuttings

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Key words: Ipil, Non-mist propagation, Rooting performance, Mist propagation, Indole butyric acid

Abstract

The paper presents an original research study conducted to investigate cost-effective techniques for the mass propagation of the hard-to-reproduce Ipil (*Intsia bijuga* (Colebr.) Kuntze) at the Clonal Facility of the Department of Environment and Natural Resources (DENR), located in Upper Pulacan, Labangan, Zamboanga Del Sur. A 2 × 6 factorial experiment in Split-Plot Design was conducted with twelve (12) treatment combinations replicated three times. The research investigated two propagation techniques (mist and non-mist) and six (6) IBA concentration levels. The study revealed significant differences among propagation systems and concentration levels. The longest roots were observed in non-treated samples (10.36 cm), while the shortest were observed in the 2000 ppm concentration (7.74 cm). The highest number of roots (12.83) was observed at 2000 ppm, whereas non-treated samples had the fewest (2.50). Additionally, both propagation methods and concentration levels showed significant differences in rooting percentage. The non-mist method combined with IBA concentrations (300 ppm and 1000 ppm) resulted in a 100% rooting percentage. Furthermore, the non-mist method exhibited significantly higher root biomass (1.98 g) compared to misting (0.51 g).No significant difference was observed in root length between the propagation methods. Similar results were found in the interaction effects between propagation methods and concentration levels. Therefore, the results indicate that Ipil (*Intsia bijuga*) can be most effectively propagated using the non-misting technique combined with IBA growth hormone, which is considered a cost-effective method for its mass propagation.

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Introduction

Ipil *(Instia bijuga)* is a highly prized plant species that thrives in Philippine beach-type forests (Orwa *et al.*, 2009). Due to its valuable wood, it has become a target for extensive logging, leading to a decline in numbers across the South Asian region, including the Philippines, where it is classified as "Vulnerable" (DAO 2007-11) *(*Cheung *et al.*, *2007;* Thaman *et al.*, *2006)*. Consequently, there is an urgent need to propagate and conserve this challenging-to-cultivate species (Eganathan *et al.*, 2000). This study examined the effects of different propagation methods and IBA concentrations on Ipil serial cuttings to develop efficient mass propagation techniques for conservation.

Materials and Methods

Experimental design and treatment

A factorial experiment (2×6) was conducted using six levels of IBA concentrations (Factor B: B1: 0 ppm, B2: 300 ppm, B3: 500 ppm, B4: 1000 ppm, B5: 1500 ppm, and B6: 2000 ppm) applied to mist (Factor A1) and non-mist (Factor A2) propagation methods. Each subplot included 20 cuttings treated with various IBA concentrations across both propagation methods, replicated three times, totaling 720 cuttings. The study was conducted at the Clonal Facility over a three-month period.

Cultural practices and management

Young stem cuttings of *Intsia bijuga* were collected from on-site seedlings. Following a protocol, the stems were cut at a right angle with leaves intact. These stems were placed in large, clear bags with a little water to prevent drying. The stems were then divided into three-node sections, each with at least a pair of leaves, which were subsequently halved and sterilized by soaking in a fungicide solution for one hour.

Next, the experimental stem cuttings were exposed to various concentrations of indole-butyric acid (IBA) (300 ppm, 500 ppm, 1000 ppm, 1500 ppm, and 2000 ppm) by immersing ¾ to 1 inch of their basal ends in the solution for one hour. These soaked cuttings were immediately transferred into hiko trays filled with rooting media containing essential nutrients for root development and survival.

The Hiko trays containing embedded *I. bijuga* cuttings were placed in both a non-mist chamber and a mist chamber, following procedures adapted from Cadiz and Barbosa (2014)**.** The non-mist chamber was tightly sealed, requiring occasional hand misting due to water loss from low ambient humidity. Regular inspections were carried out to remove dead cuttings and dry leaves to prevent contamination. Throughout the experiment, the emergence of new roots and shoots was closely monitored and documented.

Data collection

After 3 months of growth, the *I. bijuga* cuttings were extracted from the soil, gently washed, and their root lengths were measured using a calibrated ruler. The average number of roots per plot was recorded, and the rooting percentage was calculated. Root biomass was measured after drying the cuttings in an oven.

Results and discussion

The study revealed significant differences among propagation methods and concentration levels. The longest roots were observed in the control group (10.36 cm), whereas the shortest were found in the 2000 ppm treatment (7.74 cm). In terms of the number of roots, the highest count was recorded in the 2000 ppm group (12.83 roots), while the control group had the fewest (2.50 roots). On the rooting percentage, methods of propagation and levels of concentration also showed significant difference. The non-misting system in combination with the IBA concentrations (300 ppm and 1000 ppm) had yielded 100% percentage of roots. On the root biomass, methods of propagation exhibited a significant difference with non-misting method had the higher root biomass at 1.98 g while misting with only 0.51 g. On the other hand, no significant difference was observed between two methods of propagation in the length of roots. Similar result was observed for the interaction effects among methods of reproduction and levels of concentration.

Rooting percentage

The results demonstrate a statistically significant interaction between propagation methods and IBA concentration levels on the rooting percentage of *I. bijuga* cuttings. Fig. 1 illustrates that non-misting propagation with 300 ppm (B2) and 1000 ppm (B4) IBA produced the highest rooting percentages at 100%, followed by 500 ppm (B3) achieving 93%. Conversely, the mist method with 300 ppm IBA yielded the lowest rooting percentage at 30%. These findings indicate that optimal rooting performance is achieved with non-mist method and IBA concentrations of 300 ppm or 1000 ppm. Additionally, non-mist propagation with 300 ppm IBA is the economical method for stimulating root growth in Ipil cuttings.

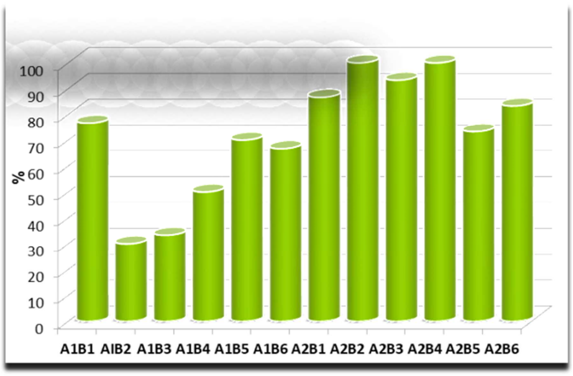

Fig. 1. Effect of propagation methods and IBA concentration on root growth (%) of Ipil serial cuttings

Length of roots

The use of the plant growth regulator (IBA) on established stem cuttings of *I. bijuga* revealed significant variation. Additionally, neither the interaction effect of mist (Factor A1) nor non-mist (Factor A2) propagation, nor its individual impact on root length, was statistically significant. Fig. 2 depicts how varying IBA concentration levels influenced the average length of rooted Ipil cuttings. Treatment 1 (Control) yielded the longest roots at 10.36 cm, followed by 2000 ppm at 7.74 cm, which is consistent with findings by Giathi *et al.* (2017). Their study on *Ocotea usambarensis* (Engl), using IBA concentrations of 0, 60, 90, and 120 mg/l, indicated no significant increase in root length with IBA treatment. Their findings suggest *O. usambarensis* may have elevated levels of endogenous auxin.

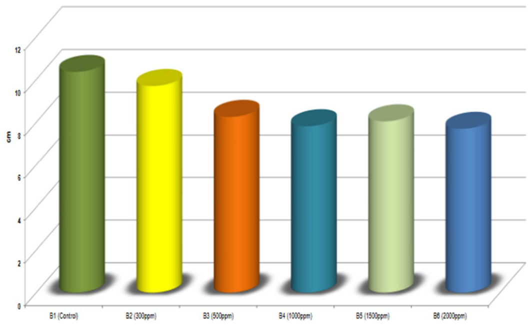

Fig. 2. Rooted length (cm) of *I. bijuga* serial cuttings in response to varying concentrations

Number of roots

The application of IBA treatment showed statistical significance enhancing root formation in cuttings of *I. bijuga*. There was no interaction between propagation methods (mist and non-mist) and IBA concentration on root development.

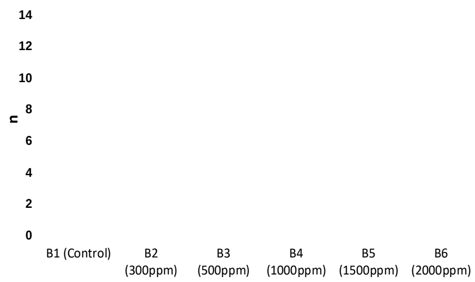

Fig. 3. Number (n) of rooted cuttings varies across different concentrations

Fig. 3 shows how IBA level of concentration influenced the number of roots in *I. bijuga* cuttings. The highest average root number, 12.83, was observed at the 2000 ppm IBA concentration, and followed by 1500 ppm IBA. Treatment 1 (control) had the lowest average root number, 2.50. This underscores that higher concentrations of IBA hormone induce greater root formation compared to control treatments. According to Eganathan *et al.*

(2000), who studied three species including *Intsia bijuga*, the application of IBA promoted optimal root and shoot growth in cuttings. Their findings suggest that I. bijuga responds particularly well to IBA, enhancing cellular metabolism and accelerating cellular division (Liu, 1993).

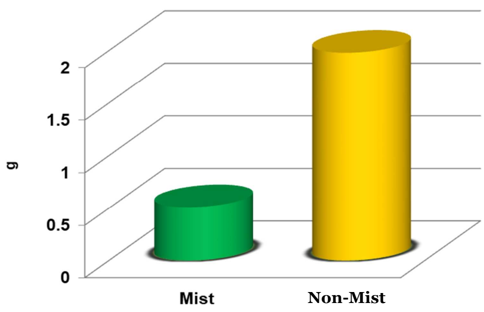

Fig. 4. The average root biomass (g) of *I. bijuga* serial cuttings under non-mist propagation methods

Root biomass

The root biomass of *I. bijuga* stem cuttings showed statistical significance. Fig. 4 illustrates that the interaction between misting propagation technique and IBA rooting hormone did not significantly affect the root biomass of the cuttings. The non-mist method exhibited a higher mean root biomass of 1.98 g compared to the mist method, which averaged 0.51 g. The highest root biomass of 2.72 g was recorded at the 1500 ppm IBA concentration, followed by 1000 ppm at 2.25 g and 2000 ppm at 2.15 g. In contrast, the control treatment exhibited the lowest root biomass at 0.88 g. It was observed that the non-mist propagation system, with its application of IBA rooting hormone and nutrient support for root development, contributed to improved root biomass per cutting.

Conclusion

The root biomass responded best to non-mist propagation methods, known for their affordability and accessibility. While root quantity, length, and rooting percentage showed no significant differences, notable variations were seen in IBA rooting hormone concentrations. The longest roots were observed with the control treatment and at 300 ppm, indicating effective root growth in I. bijuga stem cuttings regardless of IBA presence. Non-mist propagation consistently performed well across all six hormone concentrations.

Recommendation

Considering the study's findings and limitations, several recommendations can be proposed to improve the propagation and growth outcomes of Ipil *(Intsia bijuga)* through serial cuttings:

1. Firstly, conduct further research to confirm the impact of Indole-Butyric Acid (IBA) and different intervals between serial cuttings (1-2 and 4-5) on root development and shoot production.
2. Second, utilize the non-mist propagation method for better root biomass development. This method demonstrated a higher mean root biomass compared to misting propagation.
3. Third, extend the observation period (1 month, 2 months, and 4 months) to comprehensively assess the long-term rooting performance of Ipil cuttings.
4. Lastly, investigate the efficacy of alternative commercially available rooting hormones to potentially enhance rooting performance beyond that achieved with IBA.

These steps aim to improve the efficiency and effectiveness of Ipil propagation methods, thereby supporting better growth and sustainability in cultivation practices.

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