The effect of Rootone-F and coconut water on *Piper sp.* cutting growth

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Abstract. Betel is propagated by stem cutting. The success of cutting is determinate by many new roots and leaves. Synthetic or natural plant growth regulators can do induction root. This research aims to observe plant growth regulators to optimum growth of green and red betel. A completely randomized design with two factors was design treatment. The first factor was betel type (green betel and red betel), and the second factor was plant growth regulator, namely Rootone-F (5%, 10%, 15%, 20%, and 25%), coconut water (15%. 25%, 50 %, 75%, 100%), and control (water). Repeated the treatment was three times. The observed characters were life percentage, root percentage, root length, and plant height. Data obtained were analyzed with SAS 9.1 software. The results showed that green and red betel could be propagated more effectively with water than the provision of growth regulators Rootone F and coconut water. Increasing the concentration of Rootone F and coconut water significantly reduces root length and shoot length.

1. Introduction

Betel is a medicinal plant that has widely used. This plant can spread up to 15 m, and the stems are segmented with greenish-brown color. Betel leaf is shaped like a heart, long petiole, flat-leaf edge, tapered leaf tip, grooved leaf base, pinnate leaf bone, and thin leaf flesh. The roots and shoots of this plant grow from the joints in the stem. The root system is fibrous and has root stems, root branches, and root fibers. The root system that emerges from the stem knot allows making it possible to be propagated by cuttings. The success of cuttings is marked by the ability of new plants to produce fresh leaves and roots. Produce fresh leaves and roots influenced by the origin used and cutting material treatment. The cutting materials can be derived from one segment, two segments, climbing roots, or sticking roots. Treatment of cutting material is aimed to accelerate root emergence, usually by immersing it in growth regulator hormone. Saptarini [1] state, plant growth regulator, does not add nutrients, but regulate physiological processes such as cell division and elongation, and regulate the growth of roots, stems, leaves, flowers, and fruit. Plant growth regulators (ZPT) to accelerate root growth can be synthetic and natural. Synthetic ZPT such as Rootone-F, Benzyl Amino Purine (BAP), naphthalenenenetic acid (NAA), 2,4-dichlorophenoxyacetic acid (2,4-D), and natural such as coconut water, shallots, tomato extract, bean sprouts extract, cow, goat, and rabbit urine. Rootzone-F is a synthetic plant growth regulator that consists of IBA and NAA and very effective in stimulating sprouting and root growth of cuttings [2], [3]. Coconut water contains hormones such as cytokinins 5.8 mg l^{-1}, auxins 0.07 mg l^{-1}, gibberellins, and other compounds that can stimulate growth and germination.

Rootzone-F showed the best results on the number of shoots, shoot length, number of leaves, leaf area, number of roots, and root length of jasmine shoot cuttings [4]. Sudomo [5] research stated that applying Rootone-F smeared resulted in the highest percentage of life (22.68%) on Manglid shoot cuttings. Rootzone-F 300 mg/L concentration showed the best growth on multiplication of Begona tuberose Lmk by stem cuttings [3]. [6] the asked concentration of 200 ppm Rootone-F gives the best shoot height, root length, and leaf number of Cadam (*Anthocephalus cadamba*) shoot cutting. Adding Rootone-F 100 ppm on stem cuttings of Puri (*Mitragyna speciosa* Korth) increase the number of shoots and roots [7]. [8] Coconut water as a growth regulator could increase teak (Tectona grandis) stem cutting 50%--100% with the best dose was 100%. Coconut water is one of the cheapest ways to induce some roots and shoots in Ixora [9]. This study aimed to increase betel seeds' viability using synthetic (Rootone-F) and natural (coconut water) ZPT.

2. Methods

This research was conducted from February to June 2019 at the Greenhouse of the Indonesian Spice and Medicinal Crops Research Institute (ISMCRI) Bogor, West Java. The materials used were cuttings derived from one leaf of green betel (*Piper betle* L.) and red betel (*Piper crocatum* Ruiz & Pav.) Betel cuttings obtained from the propagation of stem cuttings of parent plan with five years old. The environmental design used was a complete randomized block with two factors. The first factor is the type of betel (green betel and red betel), and the second factor is a plant growth regulator, namely Rootone-F (5%, 10%, 15%, 20%, and 25%), coconut water (15%, 25%, 50%, 75%, 100%), and water as a control. Betel cuttings soaked for 48 hours in each treatment. Each treatment was repeated three times, with three cuttings per replication. The characters observed were related to cutting viability (percentage of survival, percentage of root emergence, root length, and plant height). The data obtained then tested with analysis of variance at a 5% confidence level using SAS 9.1 software.

3. Result and Discussion

The cuttings of green betel and red betel were cut with two books/one segment and one leaf (Figure 1). There was a significant interaction between betel type and Rootone F concentration to the percentage of life and shoot length (Table 1). Green betel has given Rootone-F 25 ppm, and 100% coconut water had a lower life percentage than other treatment concentrations and water. Red betel has given Rootone-F 15 ppm, and coconut water 50% has a lower life percentage than other concentrations and water. Application of Rootone-F above 120 ppm has inhibited the growth of sandalwood (*Santalum album Linn*) stump; this means plant growth regulators above the concentration considered too high, exceeding optimal dose for growth and potential damage and poisoning plants [10].

Figure 1. Cuttings of green betel and red betel plants.

Application of plant growth regulator in high concentration can damage the plant, inhibits growth and development of shoots, causing yellowing and leaf fall, blackening stems, and eventually causing

death. That damage can also result because of the cutting material, which too young or too old. Stems that are too young will evaporate very quickly, so cuttings will weaken and die, while stems that too old contain little carbohydrates or natural hormones and inhibit shoot and root growth. The symptoms are marked decay of leaves and shoot that dry out, then stems begin to dry out and die [11].

Table 1. Interaction of betel type and plant growth regulator to life percentage (%).

Betel Type	Plant growth regulator		Life percentage (%)
Green betel	Control		100.0[a]
	Rootzone-F	5 ppm	100.0[a]
		10 ppm	91.7[ab]
		15 ppm	83.3[ab]
		20 ppm	91.7[ab]
		25 ppm	83.3[ab]
	Coconut water	15%	100.0[a]
		25%	100.0[a]
		50%	100.0[a]
		75%	100.0[a]
		100%	66.7[abcd]
Red betel	Control		100.0[a]
	Rootzone-F	5 ppm	100.0[a]
		10 ppm	83.3[ab]
		15 ppm	58.3[bcd]
		20 ppm	83.3[ab]
		25 ppm	75.0[abc]
	Coconut water	15%	91.7[ab]
		25%	83.3[ab]
		50%	33.3[d]
		75%	66.7[abcd]
		100%	41.0[cd]

MAT = The average value followed by the same letter in the same column is not significantly different at 5% DMRT.

The treatment of betel type and plant growth regulators concentration on the variable had significant interaction on life percentage, shoot length, root emergence, and shoot length. Green betel has given Rootone-F 25 ppm, and 100% coconut water had smaller root cuttings, root length, and plant height than water control and other concentrations. Red betel has given Rootone-F 15 ppm, and 50% coconut water had root cuttings, root length, plant height lower than water as a control, and other concentrations. Rootzone-F is a synthetic plant growth regulator that contains auxin hormone. Auxins effect on cutting roots is increased root formation and the number of roots [12].

Table 2. Interaction of betel type and plant growth regulator to rooting cutting, root length, and plant height.

Betel type	Plant growth regulator		Rooting cutting (%)	Root length (cm)	Plant height (cm)
Green betel	Control		100.00^{a}	4.35^{bc}	2.55 ^{abc}
	Rootone-F	5 ppm	100.00^{a}	5.92^{ab}	2.05^{abcde}
		10 ppm	91.67^{ab}	5.89^{ab}	1.87^{abcdef}
		15 ppm	83.33^{ab}	4.93^{abc}	1.73^{abcdefg}
		20 ppm	83.33^{ab}	4.77^{bc}	3.03^{a}
		25 ppm	83.33^{ab}	4.86^{abc}	1.68^{abcdefg}
	Coconut water	15%	100.00^{a}	6.64^{a}	2.38^{abcd}
		25%	100.00^{a}	4.96^{ab}	1.27^{cdefgh}
		50%	91.67^{ab}	3.91^{c}	2.83^{ab}
		75%	91.67^{ab}	4.00^{c}	2.34^{abcd}
		100%	16.67^{de}	2.00^{d}	0.17^{h}
Red betel	Control		100.00^{a}	4.35^{bc}	2.55^{abc}
	Rootone-F	5 ppm	33.33^{cde}	2.00^{d}	0.72^{efgh}
		10 ppm	41.67^{cd}	0.97^{d}	0.97^{defgh}
		15 ppm	16.67^{de}	0.90^{d}	1.50^{bcdefgh}
		20 ppm	58.33^{cd}	2.20^{d}	1.68^{abcdefg}
		25 ppm	33.33^{cde}	1.60^{d}	1.80^{abcdef}
	Coconut water	15%	58.33^{cd}	2.19^{d}	1.55^{abcdefgh}
		25%	58.33^{cd}	1.24^{d}	1.02^{defgh}
		50%	25.00^{de}	0.48^{d}	0.40^{fgh}
		75%	16.67^{de}	0.77^{d}	0.13^{h}
		100%	8.33^{e}	0.67^{d}	0.27^{gh}

Note: The average value followed by the same letter in the same column are not significantly different at 5% DMRT

Red betel and green betel cuttings can be rooted without plant growth regulators. That can be seen from the percentage of growth, percentage of root cuttings, root length, and plant height that not significantly different from control. Figure 2 showed that red betel and green betel treated with plant growth regulators Rootone F and coconut water had grown roots and shoots. This result is similar to Payung and Susilawati [13], application of plant growth regulator (Rootone-F) has no significant effect on shoot length, the number of shoots, root length, and the number of roots of Tembesu (*Fagraea fragrans*) [13].

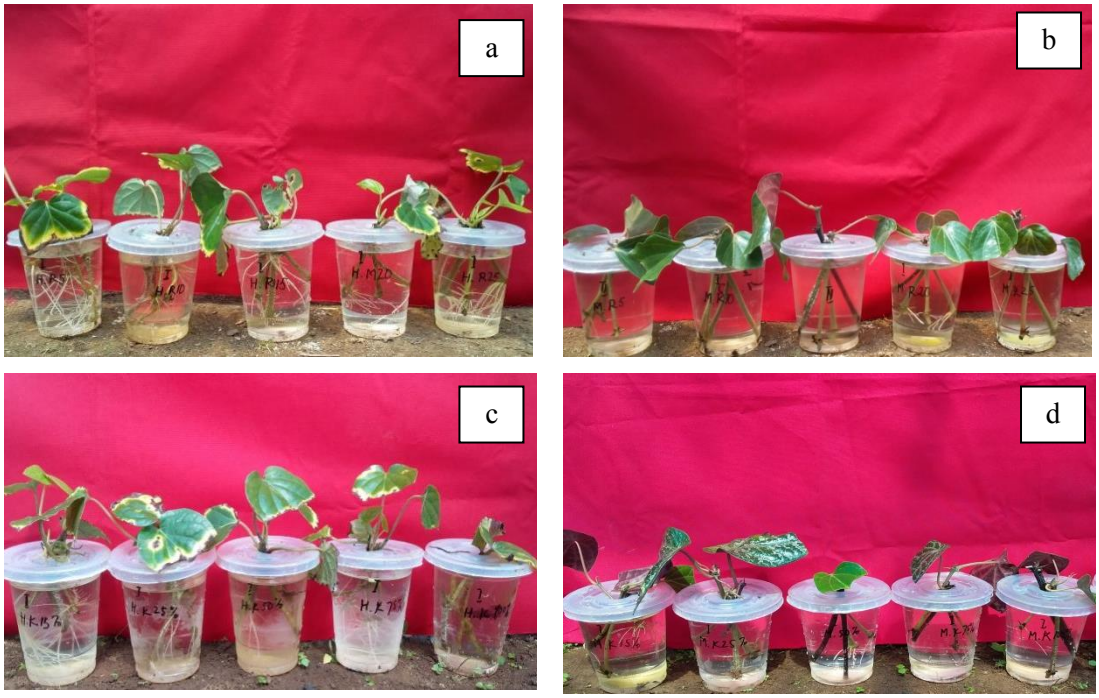

Figure 2. Two betels treated with plant growth regulators. (a) green betel treated with Rootone F; (b) red betel treated with Rootone F; (c) green treated with coconut water; (c) red betel treated with coconut water.

4. Conclusion

The treatment results showed that green betel and red betel are reproduced more optimum with water than Rootone F or coconut water. Increasing the concentration of Rootone F and coconut water to betel cutting significant reduces the growth of root length and shoot length.

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