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Effect of IBA and NAA on rooting and axillary shoot outgrowth of 'Himalayan' mulberry stem cutting

Sokhuma, P. [*]**, Intorrathed, S. and Phonpakdee, R.**

Department of Agricultural Education, Faculty of Industrial Education and Technology, King Mongkut's Institute of Technology Ladkrabang, Thailand.

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Abstract The effect of 4 different concentrations (500, 1000, 2000 and 3000 ppm) of Indole-3-Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) to root and shoot of 'Himalayan' mulberry stem cutting were studied. The result showed that after 40 days of cuttings, 3000 ppm of IBA was the best result of concentration showing 3000 ppm of IBA was 93.33 percent survival rate, 86.67 percent of rooting, 18.8 roots, 10.82 centimeters of root length, 93.33 percent of axillary shoot outgrowth, and 13.11 centimeters of axillary shoot length, 5.79 leaves, 5.1 centimeters of leaf width, and 6.84 centimeters of leaf length. Therefore, IBA 3000 ppm is suitable to use in "Himalayan" mulberry propagation by stem cutting.

Keywords: auxin, stem-cutting, mulberry, rooting, axillary shoot

Introduction

Nowadays imported fruits from overseas to Thailand increases every year. A lot of the foreign species were cultivated in the country. The farmers have found the methods of fruit production to meet the quantity and quality of imported fruits. A mulberry 'Himalayan' is a species of fruit imported and planted since the fruits are good taste and high value processing. However, the propagation of 'Himalayan' in Thailand take a long time and an expertise, since the farmers apply layering, grafting, and budding. The number of 'Himalayan' branches from those propagations are less and the price is high. 'Himalayan' Mulberry stem cuttings are taken solution to this problem.

Auxins hormone are applied in stem cutting since this hormone stimulate plant growth (Yamaguchi *et al*., 2010) and involved development of leaf, fruit, shoot, and lateral root (Bertoni, 2011). They were used in stem cuttings, especially IBA and NAA had been studied in the research of Chumpookam *et al.* (2014) about Effect of IBA and NAA on Rooting and

[*] **Corresponding Author:** Intorrathed, S.; **Email:** sarawut,in@kmitl.ac.th

Axillary Shoot Outgrowth of 'Chiangmai 60' Mulberry (*Morus alba* Linn.) stem Cutting. They found that the stem cutting which was treated with IBA and NAA were not significantly increase rooting percentage but 1,000 $mg.L^{-1}$ of IBA was appropriated for the growth of 'Chiangmai 60' mulberry propagated by stem cutting (Chumpookam *et al*., 2014).

However, the cutting of 'Himalayan' mulberry may be different from 'Chiangmai 60' mulberry since the 'Himalayan' mulberry is not native mulberry like 'Chiangmai 60'. This study aimed to study the effect of IBA and NAA on rooting and axillary shoot outgrowth of 'Himalayan' mulberry stem cutting and to compare the effect of IBA and NAA in different concentration levels on rooting and axillary shoot outgrowth of 'Himalayan' mulberry stem cutting.

Materials and methods

The materials in this research were scissors cut branches, plastic bag, plastic pots, grafting knife, ruler, Himalayan Mulberry branches, charcoal rice husk, fine sand, coconut husk chips, fungicide, IBA (500, 1000, 2000, 3000 ppm), and NAA (500, 1000, 2000, and 3000 ppm). The Completely Randomize Design (CRD) was used in the experiment with 9 treatments and 3 replications.

Table 1. Number of cutting stem in control and treatments for 3 repetitions

Experiment	Number of cutting stem		
	Repetition 1	**Repetition 2**	**Repetition 3**
Control	5	5	5
1st treatment IBA 500 ppm	5	5	5
2nd treatment IBA 1000 ppm	5	5	5
3rd treatment IBA 2000 ppm	5	5	5
4th treatment IBA 3000 ppm	5	5	5
5th treatment NAA 500 ppm	5	5	5
6th treatment NAA 1000 ppm	5	5	5
7th treatment NAA 2000 ppm	5	5	5
8th treatment IBA 3000 ppm	5	5	5

Procedure for stem cuttings

1.1 mixed the charcoal rice husk and fine sand with water

1.2 put coconut husk chips at the bottom of the pot size 12 inches and put the material from 1.1 for 3 to 4 parts of the height of the pot

1.3 selected the stem does not have a wound or pests and have perfect axillary buds

1.4 cut the 25 centimeters of the stems and removed the leaves to reduce water loss

1.5 soaked the fungicide for 30 minutes

1.6 made 3-4 vertical wounds at the lower part the stems about 2 centimeters to stimulate rooting.

1.7 soaked the stem in IBA and NAA concentration 500, 1000, 2000, and 3000 ppm for 2 minutes

1.8 pointed up the bud and inserted stem cuttings from 1.7 into the pot in 1.2 in the depth of 7.62 centimeters or more

1.9 covered the pot in 1.8 with clear plastic bag

Data collection and analysis

40 days after the cutting, number of cutting stem survived, number of cutting stem that have roots, number of roots, length of roots, number of shoots, number of leaves, length of shoot, width of leaves, and length of leaves were collected. Data were analyzed by percentage and average.

Results

The survival rate of the Himalayan mulberry stem cutting

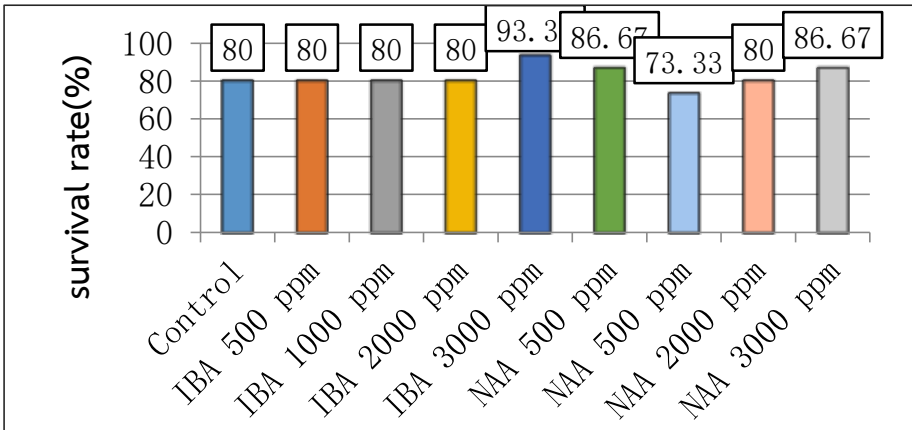

Figure 1. The survival rate of the Himalayan mulberry stem cutting

From the figure 1 shows the survival rate of the Himalayan mulberry stem cutting. It found that Himalayan mulberry stem cutting that used a plant growth regulator 'Auxin' IBA concentration of 3000 ppm had a highest survival rate (93.33 percent) while NAA concentration of 500 ppm and 3000 ppm was a bit lower (86.67 percent).

The percentage of rooting of the Himalayan mulberry stem cutting

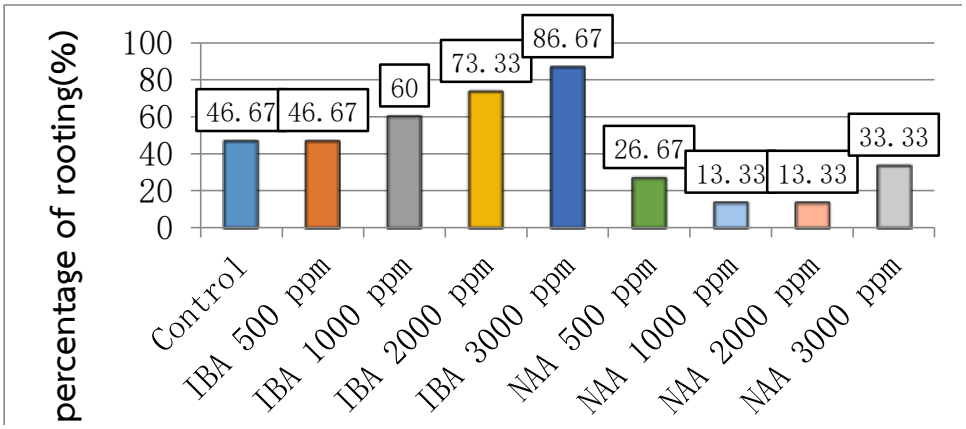

Figure 2. The percentage of rooting of the Himalayan mulberry stem cutting

From the figure 2 shows the percentage of rooting of the Himalayan mulberry stem cutting. It found that Himalayan mulberry stem cutting that use a plant growth regulator 'Auxin' IBA concentration of 3000 ppm had a highest percentage of rooting (86.67 percent) while NAA concentration of 3000 ppm was lower than control (33.33 percent).

The number of roots of the Himalayan mulberry stem cutting

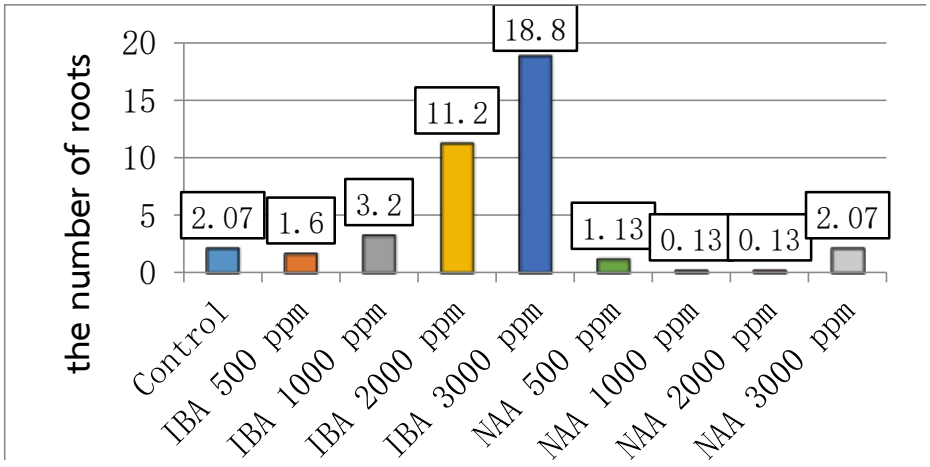

Figure 3. The number of roots of the Himalayan mulberry stem cutting

From the figure 3 shows the number of roots of the Himalayan mulberry stem cutting. It found that Himalayan mulberry stem cutting that use a plant growth regulator 'Auxin' IBA concentration of 3000 ppm had the highest number of roots (18.8 roots) while NAA concentration of 3000 ppm was equal control (2.07 roots).

The root length of the Himalayan mulberry stem cutting

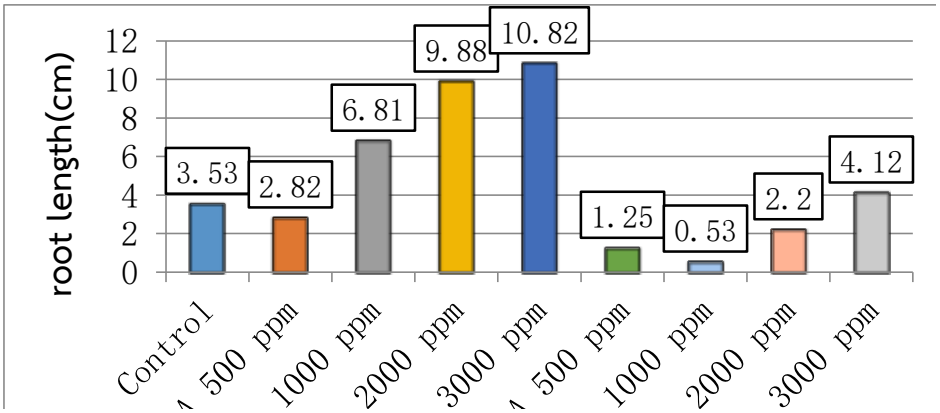

Figure 4. The root length of the Himalayan mulberry stem cutting

From the figure 4 shows the root length of the Himalayan mulberry stem cutting. It found that Himalayan mulberry stem cutting that use a plant growth regulator 'Auxin' IBA concentration of 3000 ppm had the highest average of root length (10.82 centimeters) while NAA concentration of 3000 ppm was lower than all IBA concentration (4.12 centimeters).

The percentage of axillary shoot outgrowth of the Himalayan mulberry stem cutting

From figure 5 shows the percentage of axillary shoot outgrowth of the Himalayan mulberry stem cutting. It found that Himalayan mulberry stem cutting that use a plant growth regulator 'Auxin' IBA concentration of 3000 ppm had the highest percentage of axillary shoot outgrowth (93.33 percent) while NAA concentration of 3000 ppm and 500 ppm was a bit lower (86.67 percent).

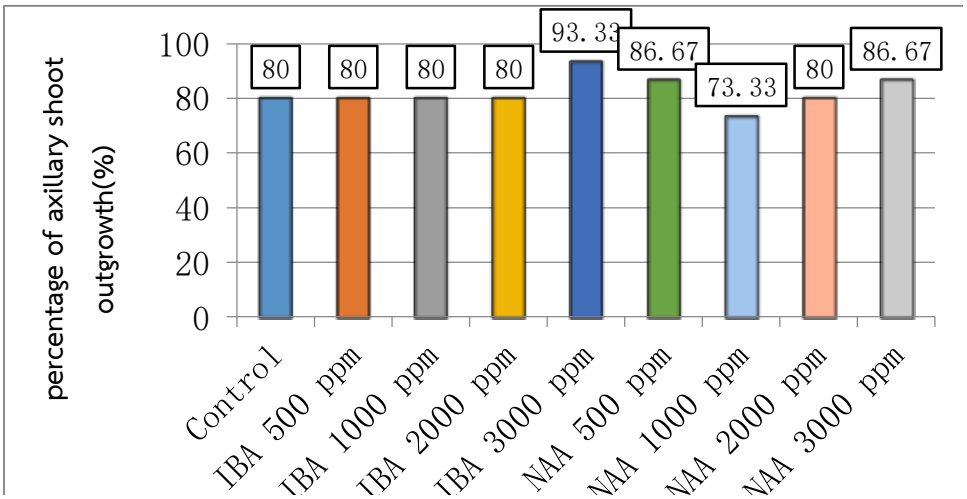

Figure 5. The percentage of axillary shoot of the Himalayan mulberry stem cutting

The axillary shoot length of the Himalayan mulberry stem cutting

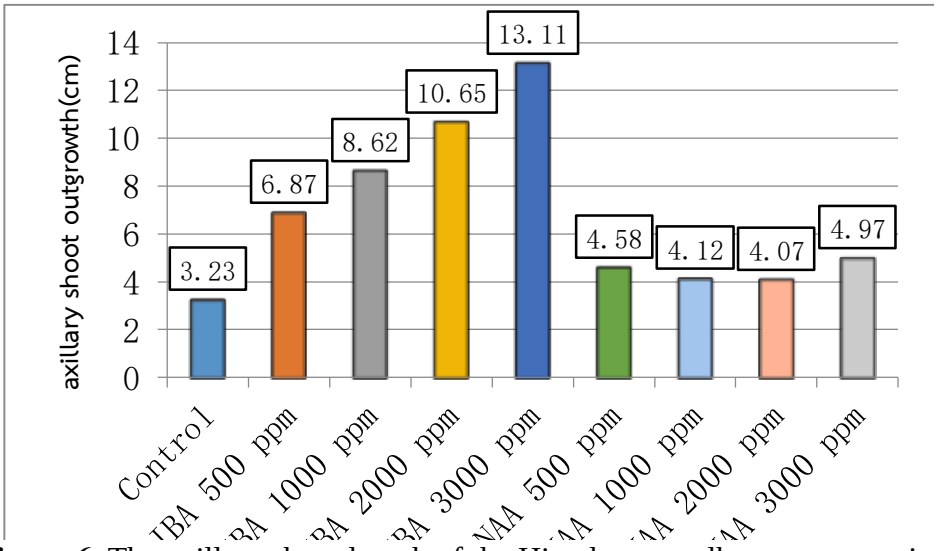

Figure 6. The axillary shoot length of the Himalayan mulberry stem cutting

From the figure 6 shows the axillary shoot length of the Himalayan mulberry stem cutting. It found that Himalayan mulberry stem cutting that use a plant growth regulator 'Auxin' IBA concentration of 3000 ppm had the highest average of axillary shoot length (13.11 centimeters) while NAA concentration of 3000 ppm was lower than IBA concentration of 2000, 1000, and 500 ppm (4.97 centimeters).

The number of leaves of the Himalayan mulberry stem cutting

From the figure 7 shows the number of leaves of the Himalayan mulberry stem cutting. It found that Himalayan mulberry stem cutting that use a plant growth regulator 'Auxin' IBA concentration of 3000 ppm had the highest number of leaves (5.79 leaves) while all NAA concentration was lower than control.

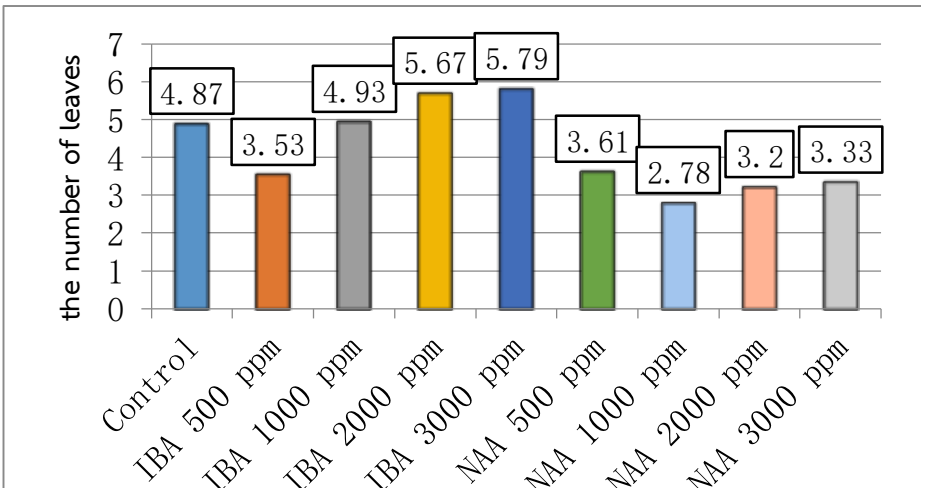

Figure 7. The number of leaves of the Himalayan mulberry stem cutting

The leaf width of the Himalayan mulberry stem cutting

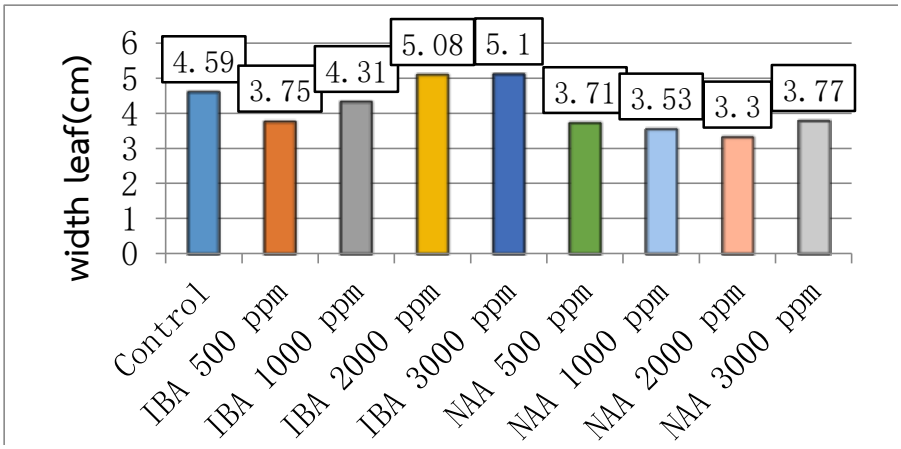

Figure 8. The width leaf of the Himalayan mulberry stem cutting

From the figure 8 shows the leaf width of the Himalayan mulberry stem cutting. It found that Himalayan mulberry stem cutting that use a plant growth regulator 'Auxin' IBA concentration of 3000 ppm had the highest average of leaf width (5.10 centimeters.) while all NAA concentrations was lower than control.

The leaf length of the Himalayan mulberry stem cutting

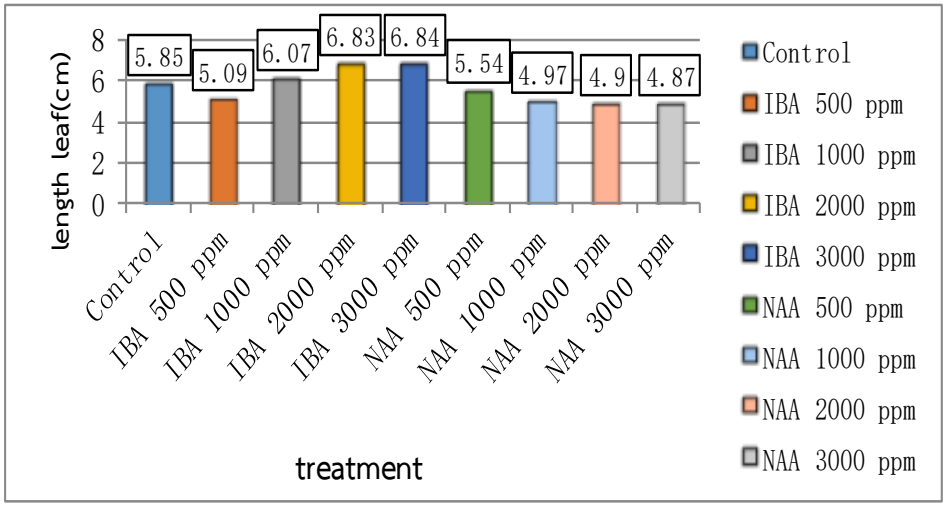

Figure 9. The length leaf of the Himalayan mulberry stem cutting

From the figure 9 shows the length leaf of the Himalayan mulberry stem cutting. It found that Himalayan mulberry stem cutting that use a plant growth regulator 'Auxin' IBA concentration of 3000 ppm had the highest average of leaf length (6.84 centimeters.) while all NAA concentrations was lower than control.

Discussion

The results showed that, there is no difference in the survival rate of the Himalayan mulberry cutting stem in all treatments, the survival rates are in the range of 73.33 to 93.33 percent. Results of percentage of rooting, the number of roots, and root length of the Himalayan mulberry cutting stem, found that the treatment auxin IBA concentration of 3000 ppm had the highest rooting (86.67 percent), number of roots (18.8 roots), and root length (10.82 cm). This is cons istent with the research results of Aminah (1995) that the application of auxin IBA significantly increased the rate of root emergence in single node leafy stem

cuttings of *Shorea leprosula*. The IBA can break down and decompose quickly to a low concentration which is appropriate to change the root meristem to be root (Tongumpai, 1994).

3000 ppm of IBA was the best results of all concentrations: 93.33% of survival rate, 86.67 % of rooting, 18.8 roots, 10.82 centimeters of root length, 93.33% of axillary shoot outgrowth, and 13.11 centimeters of axillary shoot length, 5.79 leaves, 5.1 centimeters of leaf width, and 6.84 centimeters of leaf length. Therefore, IBA 3000 ppm is suitable to use in "Himalayan" mulberry propagation by stem cutting. This results are different from the research of Chumpookam *et al.* (2014) that reported that 2,000 $mg.L^{-1}$ IBA gave highest number of roots (69.50 roots), 3,000 $mg.L^{-1}$ IBA gave highest root length (11.67 centimeter), 2,000 $mg.L^{-1}$ NAA gave highest diameter (0.97 millimeter), 1,000 $mg.L^{-1}$ IBA gave highest leaf width and leaf length of 3.92 and 4.76 centimeter.

Acknowledgement

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