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Short Communication

Effect of Indole Butyric Acid on Raising Plants from Stem Cuttings of Tea (*Camellia sinensis* L.) in The Nursery

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Abstract

A field experiment was conducted at the central nursery of tea extension center of Bangladesh Tea Board in Bandarban during September to November, 2015 to determine the precise concentration of Indole Butyric Acid (IBA) on propagation through stem cuttings of tea. The experiment was laid out in a randomized block design with four treatments of IBA concentrations: 0 ppm (Control), 2000 ppm, 4000 ppm and 6000 ppm and each treatment was replicated four times. Basal part of tea (BT-2 variety) cuttings were dipped in different IBA concentrations for five seconds. Then these cuttings were dibbled into prepared soil mixture as rooting media. Cuttings were exposed to the rooting media for 90 days and then they all were removed carefully to assess the variation of establishment of cuttings. IBA treated cuttings showed better effect on the rooting rate, root length, root number, shoot length and survival rate compared to the control. It was noted that cuttings treated with 4000 ppm IBA produced the highest rooting rate 79.85%, the highest survival rate 57.60% and the highest root length of 4.85 cm followed by treatment 6000 ppm IBA. In case of all parameters, effects of the treatments 4000 ppm and 6000 ppm of IBA were statistically similar. Positive and strong correlation was observed both in rooting rate versus survival rate and root length versus shoot length in IBA treated cuttings. Thus, IBA at 4000 ppm concentration was recommended for establishment of stem cuttings of tea (BT-2 variety) in the nursery.

Keywords: Tea, Stem cuttings, IBA concentration.

Tea (*Camellia sinensis* L.) is a self-sterile, cross pollinated perennial crop. Propagation through true seeds do not produce true to type plants and therefore vegetative propagation is the only method of production of true to type plants. Cultivated tea is conventionally propagated by single leaf node cutting. The most desired and important factor in the selection of tea mother bush for vegetative propagation is its early rooting ability. Plant growth regulator is an important factor to determine the plant growth and their development and the scientists greatly contribute in horticulture and the practical gardener with plant growth substances to enhance the rooting of cuttings (Prockter, 1975). Establishment and growth rate of cuttings depend upon various factors such as age and mother plants vigor, woodiness and location of the stem cutting, growth regulator, environment, nutrient and genetic factors related to the genus or species of interest (Abou-Rawash *et al*., 1998). There are some interesting reports on the

response of cuttings of tea those were pre-treated with plant growth regulators.

Export of tea has been declining due to lack of exportable surplus in Bangladesh. Statistics appears that few years earlier tea was a prominent export item in our country but recently it is an import item of commodities due to tea consumption increases @ 3.23 %, whereas tea production increases @ 2% per year for the last 5 years (DPP, 2016). Therefore new extension of tea is very crucial for the growth of production to mitigate current demand as well as to save economy. Due to the stagnant condition of expansion of tea in the prevailing tea estates, Bangladesh tea board and eminent tea professionals of the country discover the potential scope of smallholding tea cultivation over the country through a feasibility study during 2002. The report reveals that 46875 hectares of land in Chittagong Hill Tracts are suitable for smallholding tea cultivation which is more than the tea planting area of estate sector in the country (PMTC, 2002). Regarding the immense scope of extension of small holding tea cultivation as a new avenue for tea, It necessitate the raising of huge amount of tea planting materials locally over the year for rapid extension of tea cultivation. But year round raising of tea clone in Chittagong Hill Tracts is a major problem due to high mortality rate of tea cutting in the nursery in winter except rainy season which hampering the progress of tea cultivation extension.

Considering the problem of poor establishment of tea stem cuttings in the nursery the present study was carried out to determine the effect of IBA and to select the optimal concentration of IBA application on tea stem cuttings for raising tea plants in the nursery.

The experiment was carried out at the central nursery of tea extension center of Bangladesh Tea Board, Bandarban district during September to December of 2015. Sandy loam soil was collected and mixed with decomposed cow dung (one-fourth of total soil), nematicide and TSP before 20 days of cuttings dibbling. Thereafter the mixture was sieved through mesh net (8 No.) for the preparation of rooting materials. The 5x7 inches sized polythene sleeves were filled with soil mixture and arranged on bed under agro shed net tunnel which protect direct sun light. Suitable shoots were collected from healthy tea bushes of clone BT-2 variety from different garden of Bandarban. Uniform single node cuttings of 2.5-3.0 cm long from new shoots were used for the experiment. Typically three, sometimes four cuttings were made from each shoot, depending on the length of the internodes of the shoot. Prepared cutting were soaked in a disinfecting solution of fungicide Cupravit for 2–3 minutes just prior to application of growth regulators. Indole Butyric Acid (IBA) at the rate of 0, 2000, 4000, 6000 ppm were applied as treatments for experiment. The solutions were prepared by dissolving 0, 200, 400, 600 mg, respectively of IBA pure crystal in drops of (1.N) NaOH and diluted with water to make 100 mL of each concentration. The base portion (1.0-1.5 cm) of cuttings were soaked carefully in solution for 5 seconds. Then these treated cuttings were planted into polythene sleeves containing prepared soil mixture as rooting media at evening.

The Randomized Block Design (RBD) was followed in the experiment in an arrangement with four replications having 20 cuttings in each replication under every treatments. The soil filled polythene sleeves with cuttings were lightly irrigated every day for first week of dibbling and then maintained one day interval for irrigation up to experimental period and besides this weeding was performed weekly. After 90 days of cuttings dibbling, various growth parameters were evaluated against the treatments. For that purpose, cuttings were carefully uprooted and medium particles adhered to roots were removed carefully by hand.

Data were collected on growth parameters i.e., rooted cutting, root number per cutting, length of root and shoot, survival rate of cutting and simple arithmetic calculation was performed to

get consolidated figure on blocks and treatments for each parameters. The data were analyzed using General Linear Model of SPSS software (version 15) and analysis of variance (ANOVA) was performed to determine the effect of different concentration of IBA on dependent variables. Means on selected parameters were compared using Tukey's test at 5% level of significance.

Rooting and survival percentage of cuttings were influenced significantly ($P<0.05$) by the application of IBA (Table 1). All treatments showed higher result over the control.

Rooting percentage of cuttings varied from 35.78% to 79.85% and the maximum (79.85%) rooting was recorded when the cuttings were treated with 4000 ppm IBA. Under treatment T_3 which was statistically identical to that of 79.78% noted in treatment T_4 at 6000 ppm IBA. The minimum rooting percentage of 35.78 % was recorded in control.

Maximum survival rate of cuttings was recorded 57.60% in treatment T_3 when the cuttings were treated with 4000 ppm IBA against minimum survival rate was 24.64% in control. Survival rate of cuttings was recorded 57.38% in treatment T_4 which was identical with treatment T_3. It was also observed that survival rate was strongly and positively correlated with rooting percentage (Figure 1).

Weaver (1972) stated that growth regulators changed the number and the type of root and IBA was a manufacturer of the strong fringe root. Khan *et al*. (1991) and Gyana (2006) also reported that treating cuttings with Indole Butyric Acid (IBA) increased the percentage of rooting, root initiation, root number and as well as uniformity of roots in *Camelia sinensis.*

Data presented in Table 1 showed that root number, root length and shoot length were influenced significantly ($P<0.05$) by the application of IBA. All treatments showed higher result over the control.

The root number per cutting ranged from 4.63 to 8.33 recorded in treatment T_1 and T_4 respectively which was gradual increase with the increased of IBA concentration. Maximum root number (8.33) was observed when the cuttings treated with 6000 ppm IBA inT_4 which was statistically similar to the data of 8.23 noted in T_3 at 4000 ppm IBA and the lowest root number (4.63) was observed in control.

The root length of the cutting was responded significantly to the treatments. The root length raged from 2.20 cm to 4.85 cm in different treatments. The maximum root length of 4.85 cm was observed in treatment T_3 at 4000 ppm IBA which was statistically similar to that of 4.80 cm noted in treatment T_4 at 6000 ppm IBA and both were significantly different to that of treatment T_1 at 0 ppm IBA and T_2 at2000 ppm IBA.

Table 1. Effect different IBA concentration on different parameters of tea cuttings establishment

Treatments (IBA doses)	Survival rate (%)	Root number (unit/cutting)	Root length (cm.)	Shoot length (cm.)	Rooting rate (%)
T_1: Control	24.64 ^{a}	4.63 ^{a}	2.20 ^{a}	5.43 ^{a}	35.78 ^{a}
T_2: 2000 ppm	29.93 ^{b}	5.25 ^{b}	2.91 ^{b}	7.85 ^{b}	45.13 ^{b}
T_3: 4000 ppm	57.60 ^{d}	8.23 ^{cd}	4.85 ^{d}	12.70 ^{cd}	79.85 ^{d}
T_4: 6000 ppm	57.38 ^{cd}	8.33 ^{d}	4.80 ^{cd}	12.98 ^{d}	79.78 ^{cd}

Means within a column followed by same letters are not significantly different at 5% level of significance according to Tukey's multiple range test.

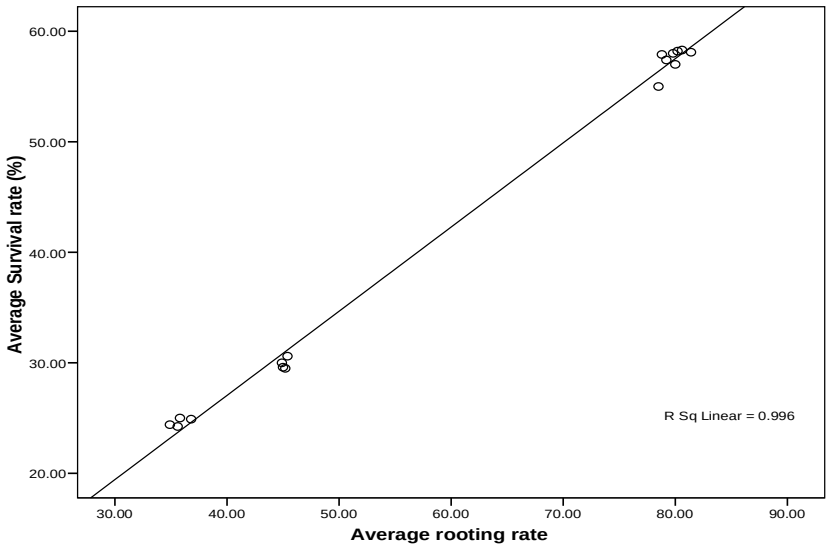

Figure 1. Relationship between rooting and survival rate of tea cutting of BT-2 variety

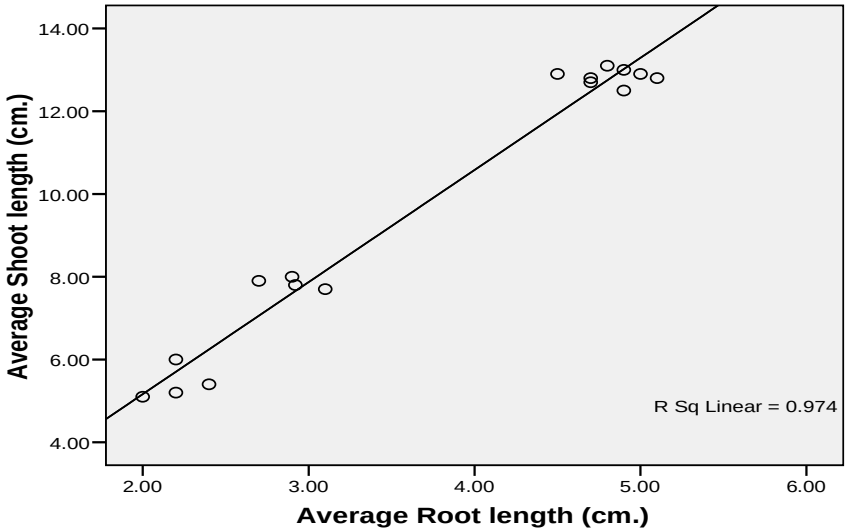

Figure 2. Relationship between root and shoot length of tea cutting of BT-2 variety

The shoot length of the cutting was responded significantly to the different treatments and ranged from 5.43 cm to 12.98 cm. The highest shoot length 12.98 cm was observed in T_4 at 6000 ppm IBA followed by the shoot length 12.70 cm inT_3 at 4000 ppm IBA and both were statistically identical. The minimum shoot length 5.43 cm was obtained in control. It was observed that root and shoot length were increased progressively with the increase of IBA concentration. It was also observed that there was a strong and positively correlation between root length and shoot length (Figure 2).

According to Badshah *et al*. (2003), IBA alone can be used for single node cutting of tea plant as plant regulator and the experimental results of 8000 ppm IBA have significantly the best result with regard to root number (9.83) of tea cutting. Xian et al. (2008) mentioned that stem cuttings pretreated with indole-3-butyric acid (IBA) in quick-dip method got the best rooting traits (rooting 86.7%, root number 23.1 and root length 6.4 cm) in Paeonia cuttings. The supported findings were reported by Reddy *et al*.(2005) who found that maximum cumulative shoot length was recorded in application of auxin at 2000-2500 ppm in scented geranium (*Pelargonium graveolens*) cuttings and auxin cause increased linear growth of stem by way of cell elongation.

The results indicated that IBA treated cuttings demonstrated better results as compared to control in all agronomic parameters. The vegetative propagation of tea through stem cuttings with IBA treatment can be applied on commercial scale for rapid multiplication. IBA application in tea cutting at 4000 ppm produced the highest rooting rate (79.85%), survival rate (57.60%) and root length (4.85 cm) and alsoat 6000 ppm produced the highest root number per cutting (8.33) and highest shoot length (12.98 cm). Results to the context ofall parameters of tea cutting establishment were found statistically similar in case of 4000 ppm and 6000 ppm IBA concentration. Hence from the results, it can be inferred that IBA had a positive effect on the establishment of stem cuttings of tea (BT-2 variety) and 4000 ppm IBA can be applied for raising better plants from stem cuttings in the tea nursery.

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