Effect of indole butyric acid (IBA) and growing conditions on success and survivability of stem cutting in plum (Prunus domestica)

N.T. Shuvra, M.A. Rahim and M.M. Hossain
Department of Horticulture, Bangladesh Agricultural University, Mymensingh-2202, Email: marahim1956@yahoo.com

Abstract: The present experiment was conducted at the FTIP, Germplasm Centre (GPC) Bangladesh Agricultural University, Mymensingh, during the period from August to December to investigate the effect of IBA and growing conditions on success and survivability of stem cutting in Plum plant. The experiment consisted of three conditions viz., (a) shade (polyhouse) with polybag, (b) open (sunlight) with polybag and (c) open bed condition. The five concentrations of IBA were 0, 50, 100, 150, and 200 ppm. The two factor experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. Thus in total 450 (5x3x3x10) cuttings were made. The results showed that all the parameters studied were significantly influenced by growing condition and different concentration of IBA on rooting of stem cutting of Plum. Shoot initiation took longer time (8.07) under bed condition and (7.98) in control while shorter time (6.01) under open condition and (5.94) in 50 ppm IBA concentration. The highest number of shoots, length of shoots, number of leaves, length of roots, fresh and dry weight of roots, percent of success and survivability (4.07, 10.55 cm, 15.00, 7.78, 28.84 cm, 0.72 g, 0.32 g, 50.45% and 44.81%, respectively) under open condition and the lowest (2.15, 4.90 cm, 3.30, 3.75, 18.04 cm, 0.27 g, 0.11 g, 12.00% and 37.57%, respectively) were observed under control. In control (0 ppm) at 10, 60, 120 DAP the number of shoots, length of shoots number of leaves, number of roots, length of roots, fresh and dry weight of roots, percent of success and survivability (4.15, 11.71 cm, 18.46, 7.81, 32.71 cm, 0.92 g, 0.36 g, 55.55% and 53.03%, respectively) were observed the highest. In control (0 ppm) at 10, 60, 120 DAP of number of shoots, length of shoots, number of leaves, number of roots, length of roots, fresh and dry weight of roots, percent of success and survivability (1.68, 4.70 cm, 1.92, 3.22, 15.75 cm, 0.16 g, 0.09 g, 8.89% and 30.84%, respectively) were observed the lowest. The combined treatments also significantly influenced all the parameters. The highest number of shoot, length of shoots, number of leaves, number of roots, length of roots, fresh and dry weight of roots, percent of success and survivability (5.36, 12.50 cm, 19.98, 9.00, 40.33 cm, 1.17 g, 0.49 g, 60.33% and 50.17%, respectively) were found under open condition with 50 ppm IBA concentration while the lowest number of shoots, length of shoots, number of leaves, number of roots, length of roots, fresh and dry weight of roots, percent of success and percent of survivability (1.47, 3.80 cm, 1.33, 1.00, 12.33 cm, 0.06 g, 0.02 g, 6.67% and 28.39%, respectively) were found under bed condition with control treatment.

Key words: Plum (Prunus domestica), indole butyric acid, growing conditions.

Introduction

Plum (Prunus domestica L.) belongs to the family Rosaceae as a subfamily, the “Prunoideae” and known as “Alubukhara” in Bengali, originated in Asia and since then, they have been grown all over the world, mainly in Iraq, Iran, Pakistan and India. In Bangladesh highly nutritious Alubukhara, a kind of plum, used to add deliciousness to different foods and drinks like sherbet and burhani, eaten fresh, dried, or prepared into preserves, jams, jellies, and juices. Prunus domestica are considered as healthy food because of lower fat contents and contain considerable amount of important nutrients like carbohydrates and minerals as well as the vitamins A and C, so they help the eyesight and help the body to absorb iron. Vitamin C is an essential nutrient for humans and a small number of other mammalian species (Hancock and Viola, 2005). Plum plant needs full sunlight and deep, well-drained soils with pH 5.5-6.5 for best results. In Bangladesh the FTIP, BAU-GPC started to cultivate the fruit but yet it is in under research to adopt with Bangladesh environment. Plums are usually propagated by budding onto either seedlings or rooted cuttings of plum plant (Yadav and Das, 1986). The percent of success, number and length of shoot, root and leaves, and fresh weight and dry weight of roots are increased significantly by using IBA (Yadav and Das, 1986). There are several researcher carried out some sort of experiment on growing condition and different concentration of IBA in developing on rooting of stem cutting (Anonymous, 2014).

Materials and Methods

The present study was conducted to investigate the effect of IBA and growing conditions on success and survivability of stem cutting in Plum plant at the Fruit Tree Improvement Program (FTIP), BAU Germplasm Centre (BAU-GPC) Bangladesh Agricultural University, Mymensingh during the period of August to December 2014. The experimental area was silt loam in texture belonging to the old Brahmaputra flood plain of AEZ 9 having non -calcareous dark grey floodplain soil. The selected area was medium high land. It was fertile and well- drained and slightly acidic with pH varying from 5.5 to 6.8. The experimental area was under the subtropical zone characterized by heavy rainfall during the month of June to September and scanty rainfall during the rest period of the year. The total rainfall of the locality was (978.4mm) during the month from August to December. The average maximum temperature 29.84°C and minimum temperature 21.42°C, respectively and the average relative humidity was 85.54% and sunshine was 150.78 hours during the months from August to December, 2014. The experiment was conducted using Randomized Complete Block Design (RCBD) with 3 replications. For each treatment combination per replication 10 cuttings were planted in each unit plot. The experiment consisted of i) three growing conditions viz., shade, bed and open.
condition and ii) five different concentrations of IBA were 0, 50, 100, 150 and 200 ppm, respectively. Thus in total 450 (3×5×3×10) cuttings were made. Plum plant suitable for propagation by stem cutting which was collected in August 2014 from 3-4 years old mature plum (Prunus domestica) trees grown in BAU Germplasm Centre. Immediately after the collection, Cuttings with one and a half centimeter in diameter 15 cm in length were prepared. Before planting, the basal parts of the stem cuttings were soaked in the solutions of different concentrations of IBA for overnight and planted in the poly bags and nursery bed at 45° angles. When the first shoot was initiating, then the data regarding days required to first shoot initiation, length of shoots, leaf number were studied. After 70 days of planting the cuttings were uprooted and the parameters roots number, length of the longest root, fresh weight of root, dry weight of root were studied. Finally the percentages of success and survivability were recorded, using the formulae (i) Percentage of success = [(Number of successfully stem cutting) ÷ (Number of cutting planted per treatment) × 100]; (ii) Percent survivility = [(Total no. of successful cuttings) – (Total no. of cuttings after success)] ÷ (Total no. of successful cutting)]. The means for all treatments were calculated and analyses of variances of parameters under study were performed by F variance test at 1% levels of significance. The mean differences were evaluated by least significant differences (LSD) test for interpretation (Gomez and Gomez 1984).

Results and Discussion

Effect of growing conditions and different concentrations of IBA on stem cutting in plum

The minimum time (6.01 days) required to shoot initiation under open condition but under bed condition required longer time (8.07) (Fig.1) The minimum time (5.94 days) required for shoot initiation at 50 ppm and the maximum time (7.98 days) was found at 0 ppm (Fig. 2).

The combined effect of growing condition and treatment on shoot initiation was also significantly difference at minimum time (5.33 days) under open condition in 50 ppm while the maximum time (9.10 days) was needed for shoot initiation in bed condition in 0 ppm (Fig. 3). The highest number of shoots (4.07) under open condition at 30 DAP and the lowest (2.15) observed under bed condition at 60 DAP (Fig.4) The highest number of shoots per stem cutting (4.15) with 50 ppm IBA at 30 DAP and the lowest (2.68) with control treatment (0 ppm) at 60 DAP (Fig.5).
The highest length of shoot (10.55 cm) under open condition at 30 DAP and the lowest (4.90 cm) was observed under bed condition at 10 DAP (Fig. 6). The highest length of shoots per stem cutting (11.71 cm) with 50 ppm at 30 DAP and the lowest (4.70 cm) with control treatment (0 ppm) at 10 DAP (Fig. 7).

![Fig. 6](image6.png)

**Fig. 6.** Main effect of growing conditions on length of shoots per stem cutting. Vertical bars represent LSD at 1% level of significance.

The highest number of leaves (15.00) under open condition at 30 DAP and the lowest (3.30) was produced under bed condition at 60 DAP (Fig. 8). The highest number of leaves per stem cutting (18.46) with 50 ppm IBA at 30 DAP and the lowest (9.51) with control treatment (0 ppm) at 60 DAP (Fig. 9).

![Fig. 7](image7.png)

**Fig. 7.** Main effect of different concentration of IBA on length of shoots per stem cutting. Vertical bars represent LSD at 1% level of significance.

The highest number of leaves (15.00) under open condition at 30 DAP and the lowest (3.30) was produced under bed condition at 60 DAP (Fig. 8). The highest number of leaves per stem cutting (18.46) with 50 ppm IBA at 30 DAP and the lowest (9.51) with control treatment (0 ppm) at 60 DAP (Fig. 9).

![Fig. 8](image8.png)

**Fig. 8.** Main effect of growing conditions on number of leaves per stem cutting. Vertical bars represent LSD at 1% level of significance.

The highest percentage of success (50.45%) was recorded in open condition and the lowest (12.00%) observed under bed condition after 60 days of planting (Fig. 10). The highest percentage of success (55.55%) was achieved at 50 ppm IBA at 60 DAP and the lowest percentage of success (8.89%) was recorded at control treatment (0 ppm) at 10 DAP (Fig. 11).

![Fig. 9](image9.png)

**Fig. 9.** Main effect of different concentration of IBA on number of leaves per stem cutting. Vertical bars represent LSD at 1% level of significance.

The highest percentage of success (50.45%) was recorded in open condition and the lowest (12.00%) observed under bed condition after 60 days of planting (Fig. 10). The highest percentage of success (55.55%) was achieved at 50 ppm IBA at 60 DAP and the lowest percentage of success (8.89%) was recorded at control treatment (0 ppm) at 10 DAP (Fig. 11).

![Fig. 10](image10.png)

**Fig. 10.** Main effect of growing conditions on percentage of success of the cutting. Vertical bars represent LSD at 1% level of significance.

After 120 days of planting, the highest percentage of survivability (44.81%) recorded in open condition and the lowest (37.57%) under bed condition (Fig. 12). The highest percentage of survivability (53.03%) was achieved at 50 ppm IBA and the lowest (30.84%) was recorded at 0 ppm. (Fig. 13). Combined effect of the highest percentage of survivability of roots (56.17%) recorded under open

![Fig. 11](image11.png)

**Fig. 11.** Main effect of different concentration of IBA on percentage of Success of the cutting. Vertical bars represent LSD at 1% level of significance.
condition in 50 ppm IBA at 120 DAP and the lowest (28.39%) in control treatment (0 ppm) under bed condition at 120 DAP (Fig. 14).

In this experiment, the effect of growing conditions and different concentrations of IBA brought satisfactory results on success and survivability rates of stem cuttings in Plum (*Prunus domestica*). From the findings of this study it may be concluded that among all the factors, open condition showed the highest success on root formation of plum. Also it was observed that the root number, root length, fresh and dry weight of root, was found the highest when it was grown under open condition. On the other hand, treatment with IBA at 50 ppm from different concentrations significantly influenced all the parameters studied. The highest success and survivability of cutting were found in the treatment combinations of open condition with 50 ppm IBA and the lowest success and survivability of cutting were found in the treatment combination of bed condition with control (0) ppm IBA.

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