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## Effect of Different Concentrations of Indole Butyric Acid (IBA) on Root Initiation and Plant Survival of Apple Cuttings

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### Abstract

The effect of different concentration of Indole Butyric Acid (IBA) on root initiation of apple cuttings. IBA was applied in five different concentrations (1000 ppm, 2000 ppm, 3000 ppm, 4000 ppm and 5000 ppm) to study number of days to bud sprouting, number of shoots per cuttings, shoot length, number of leaves per cuttings, number of roots per cutting, root length and survival percentage. Significant results were obtained from all the parameters except number of leaves per cutting. Minimum days (15.00) to bud sprouting were recorded in cuttings treated with 3000 ppm, while maximum days were taken by untreated cuttings. Maximum number of shoots (3.00) and maximum shoot length (8.00 cm) were obtained from 3000 ppm, while same were minimum in case of Ti (control). Maximum number of roots (7.00) and maximum root length (11.25 cm) were observed in cuttings treated with 3000 ppm, while minimum number of roots (4.00) and minimum root length (7.00 cm) were observed in control. Best plant survival (76.67 %) was given with 3000 ppm concentration, while it was minimum (16.67 %) when the cuttings were not treated with IBA.

### Introduction

Recently synthetic hormones are commonly available in the market that are used in stem cuttings of fruit species which are difficult to root from cuttings. Khan (1986) treated single node cuttings of *Ficus elastica* L. with 1000 ppm indole butyric acid and observed maximum number of rootings. Javanevio and Gigic (1979) also got maximum number of roots with 1000 to 1500 ppm IBA in M-9, M-26 and MM-106 apples. Higher rates of applications were reported the best. Pandey and Pathak (1981) took cuttings of clonal rootstocks of apple in December and dipped them for five seconds in several growth regulators and then inserted in hot bin at 21°C. It was reported that the best rooting of 80, 75, 66.8 and 56.6 percent were obtained in MM-115, MM-104 and M-2 respectively, whereas the best survival was recorded at 2500 ppm by the application of IBA. Ahad *et al.* (1982) revealed that highest number and maximum length of roots were recorded in the cuttings of apple cv. Reddelious treated with IAA 20 ppm. Tready (1983) described that rooting percentage could be increased from 0-30.5 percent in hard wood cuttings of apple treated with 5000 ppm IBA. He further stated that indole butyric acid enhanced the rooting in two years old cuttings. Hartman (1985) dipped the stem cuttings of apple and prunes at 2000-4000 ppm of indole butyric acid. Best rooting of 50-60 percent were observed with IBA. Ahad *et al.* (1996) found that cutting of apples from one year old shoots when immersed in 10,000 ppm IBA produced maximum number of roots and root length with survival of all plants.

Pathak (1990) concluded that the cuttings were treated with 5000 ppm of IBA gave best result. Keeping in view the

importance of apples fruit species a research project was initiated to study the effect of different concentrations of Indole Butyric Acid (IBA) on root initiation of apple cuttings.

### Materials and Methods

The experiment was conducted at the experimental area of Agriculture Research Station, Mingora, Swat. It was practiced in the open field. The following materials and methods were followed.

**Preparation of Land:** The cuttings of rootstocks MM-106 were taken and planted in a well prepared bed in the month of March after hormones treatment. The size of cuttings was 22 cm long and having 3-4 buds.

**Application of Hormones and Planting of cuttings:** For this purpose the basal ends of the cuttings (upto 6 cm) were dipped in prepared concentrations of IBA, which were prepared in the following way.

Concentration	Weight of solution IBA
1000 ppm	1 gm
2000 ppm	2 gm
3000 ppm	3 gm
4000 ppm	4 gm
5000 ppm	5 gm

The treated cuttings were planted at the depth of 8 cm in the soil. After planting, a light irrigation was given and the second irrigation was applied after 7 days and the third irrigation was given after 10 days of the second irrigation. Then the cuttings were watered at weekly intervals till the last observation was recorded.

**Design:** The experiment was laid out in Randomised Complete Block Design with the following treatments which were replicated three times.

Number of days to bud sprouting, Number of shoots, Shoot length, Number of leaves/cuttings, Plant survival percentage, Number of shoot/cuttings and Root length were studied.

The data were analyzed statistically by using Analysis of Variance Technique (Steel and Torrie, 1980) and the Duncan's Multiple Range Test (Duncan, 1955) at 1 percent level was used to compare the differences among the different treatment means, if any. The analysis were performed by the help of computer using MSTATC software package.

## Results and Discussion

**Days to Sprouting:** The significantly affected data regarding the number of days taken to sprouting is presented in Table 1. The maximum number of days (22.00) to bud sprouting were taken by Control, followed by 4000 ppm with 20.00 days. While the minimum days 15.00 were taken by the cuttings treated with 3000 ppm of IBA. This variation might be due to the application of IBA in different concentrations, as some concentrations might have brought early breakage of bud dormancy, resulting in early bud sprouting.

**Number of Shoots per cutting:** The data indicating the number of shoots per cutting is given in Table 1. Statistical analysis showed that the number of shoots per cutting was significantly affected by different concentrations of IBA. Maximum number of shoots (3.00) was observed in 3000 ppm while 4000 ppm, 2000 ppm and 5000 ppm were statistically at par with 2.25, 2.00 and 2.00 shoots per cutting. Whereas the minimum number of shoots per cutting (1.00) was observed in Control. It is obvious from the table that the number of shoots increases with the increase in the concentration upto 3000 ppm but decreases gradually above this concentration. It may be due to some physiological functions of the plant which may be enhanced favourably by this concentration.

**Shoot Length:** The data showing the length of shoots (cm) and was significantly affected by different concentrations of IBA is being presented in Table 1. The cuttings treated with 3000 ppm of IBA attained the maximum shoot length (8.00 cm) followed by those treated with 4000 ppm having shoot length of 7.75 cm. Minimum shoot length was observed in the treatment Control. It is obvious from the table that the shoot length increases with the increase in

the concentration upto 3000 ppm but decreases gradually above this concentration. It may be due to some physiological functions of the plant which may be enhanced favourably by this concentration.

**Number of Leaves per cutting:** Data presented in Table 1 regarding number of leaves per cutting showed non-significant results. Maximum number of leaves (8.08) per cutting was observed in 3000 ppm closely followed by 2000 ppm with 7.75 number of leaves per cutting. While the minimum number of leaves (5.25) per cutting were recorded in Control. These results are contradictory to those of Khattak (1990) who observed maximum number of leaves in guava stem cuttings treated with 5000 ppm.

**Plant Survival Percentage:** The data pertaining to the plant survival percentage is presented in Table 2. Statistical analysis showed that the plant survival percentage was significantly influenced by different concentrations of IBA. Maximum survival of 76.67 percent was recorded in the cuttings treated with 3000 ppm followed by T5 (4000 ppm) with 63.33 percent plant survival. While the minimum survival percentage of 16.67 per cent was obtained in T1 (Control). These differences among the survival percentage might be attributed to the varying concentrations of IBA. The data showed that the plant survival percentage increased upto 3000 ppm level and then began to decline above this concentration. It might be due to the characteristics of growth hormones that upto the optimum level, they showed regular effect, but above that optimum level they start their inhibitory effect. These results corroborate with the findings of Pandy and Pathak (1987) who observed that survival percentage at 2500 ppm of IBA

**Number of Roots per cutting:** The data regarding to the number of roots per cutting are given in Table 2. Statistical analysis revealed that the number of roots per cutting was significantly affected by the different concentrations of IBA. Maximum number of roots (7.00) were observed in treatment 3000 ppm followed by the treatments 2000 ppm and T5(4000 ppm) gave similar results each producing 6.5 roots per cutting. While the minimum number of roots (4.00) was recorded in treatment Control. The variation in number of roots might be due to the different concentrations of IBA, because this hormone helps the plant (cutting) in callus formation. The data shows that the number of roots increased upto 3000 ppm level and then began to decline above this concentration.

**Root Length (cm):** The data pertaining to the root length (cm) per cutting are presented in Table 2. The maximum root length of 11.25 cm was recorded by the cuttings placed in 3000 ppm IBA solution, followed by 4000

Table 1: Number of days to bud sprouting, number of shoots per cutting, shoot length (cm) and number of leaves/cuttings as effected by the different concentrations of Indole Butyric Acid (IBA).

Treatment	Days to Bud sprouting	No. Of shoots per cutting	Shoot length (cm)	No. Of leaves per cutting
Control	22.00 A	1.00 B	5.50C	5.25 N.S
1000 ppm	19.00 AB	1.75 AB	6.00 BC	6.50
2000 ppm	18.00 AB	2.00 AB	7.32 AB	7.75
3000 ppm	15.00 B	3.00 A	8.00 A	8.08
4000 ppm	20.00 AB	2.25 AB	7.75 A	7.00
5000 ppm	18.00 AB	2.00 AB	6.50 ABC	6.50

Means followed by same letter(s) are not significantly different at 1 per cent level of significance according to D.M.R Test.

Table 2: Plant survival percentage, number of roots per cutting and root length (cm) as effected by different concentrations of Indole Butyric Acid (IBA).

Treatments	Plant Sur: percentage	No. of roots per cutting	Root length (cm)
Control	16.67 D	4.00 D0	7.00 C
1000 ppm	36.67 C	5.00 CD	8.42 BC
2000 ppm	53.33 B	6.50 AB	9.60 AB
3000 ppm	76.67 A	7.00 A	11.25 A
4000 ppm	63.33 AB	6.50 AB	10.75 AB
5000 ppm	56.67 B	5.25 BC	9.50 AB

Means followed by same letter (s) are not significantly different at 1 per cent level of significant according to DMR Test.

ppm) which gave a root length of 10.75 cm. Whereas the minimum root length of 7.00 cm was recorded by the cuttings which were not treated with IBA. These differences in the length of roots might be due to the different concerntration of IBA.

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