

EFFECT OF DIFFERENT GROWTH-REGULATORS AND TYPES OF CUTTINGS ON ROOTING OF GUAVA (*Psidium guajava* L).

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ABSTRACT

In the research trial, three different growth-regulators Indole butyric acid (IBA), Naphthalene acetic acid (NAA) and Paclobutrazole, each with 1000 ppm in aqueous solution, were applied on hardwood, semi-hardwood and softwood cuttings. The results obtained show that maximum sprouting per cuttings (71.22%), more number of branches (3.44), maximum root-weight (1.46g), and better survival percentage (57.22%) and more no. of branches (3.44) were noted in softwood cutting treated with paclobutrazol at the 100 ppm solution. Maximum number of roots (59.66), and lengthy shoot (8.24 cm) was recorded in softwood cuttings treated with IBA at 1000 ppm. Similarly, early sprouting (17.68 days) and maximum root-length of 12.81 cm was observed in softwood cutting, respectively treated with NAA at concentration of 1000 ppm respectively. In general, the response of growth-regulators on hardwood cuttings completely failed to manifest their superiority in the trial. As whole softwood cuttings treated with paclobutrazol gave good performance as compared to IBA and NAA.

Keywords: Guava, Propagation, Cuttings, IBA, NAA and Paclobutrazole

INTRODUCTION

Guava (*Psidium guajava* L.) belongs to the family Myrtaceae. It is one of the important species that can tolerate a wide range of soil and climatic conditions. The tree is fairly salt and drought-resistant and can be grown on a variety of soils i.e. sand, clay loamy, deep, shallow, acidic and alkaline with a pH ranging from 4.5 to 8.5 (Elbaradi, 1975). Guava is one of the important fruits of Pakistan. It enjoys 4th position in economy, in relation to fruit industry of Pakistan, covering an area of 49.20 hectares with total production of 373.100 tonnes of fruits annually. In NWFP it covers an area of 3200 hectares, which produces 30,800 tonnes of fruits annually. (Agri. Statistics of Pak. 1999-2000). The main production areas in NWFP are Kohat, Mardan and Hazara. Vegetative means of propagation can be approached through the use of chemical and growth regulators. Reddy and Majumder (1970) reported that

cuttings of guava were dipped in IBA at 0-5000 ppm for 15 seconds and then dipped in one of the several phenolic compounds at 0-2000 ppm for 15 seconds. Rooting was increased from cuttings.

Andrew (1980) reported that paclobutrazol (PB) is a powerful growth-retardant that effectively inhibits shoot-growth in some fruits and herbaceous plants. He applied two levels of PB (0.500 mg liter⁻¹, 650 mg liter⁻¹) as a foliar spray to the upper portion of the canopy of grapevines. He observed that PB reduced growth of lateral shoots but vine size was not reduced by PB application. Walley et al (1981) treated the hardwood cuttings of guava with 50-3000 ppm IBA alone or 50-3000 ppm IBA+2 - naphthol (2-10 ppm) and with 50-3000 ppm NAA. The highest success of 40% was obtained from the cuttings which were treated with IBA alone. Tready (1983) described that rooting percentage could be increased from 0 to 30.5 percent in hardwood cuttings of guava treated with 500 ppm IBA. He further stated that IBA enhanced rooting in case of two-year old cuttings. Khattak et al (1983) tried IBA at different concentration in semi hardwood cuttings of guava and achieved 4% rooting in cuttings of guava with the treatment of 6000 ppm of IBA. Hafeez ur Rahman et al (1990) reported obtaining maximum from June 15 to August 30 when the cuttings were dipped in 3 ppm solution for 24 hours.

The present study aims:

- To find out the effect of different concentrations of Paclobutrazole, IBA and NAA on root-initiation of guava cuttings.
- To select the best growth-regulator for maximum root-initiation and survival of cuttings of Guava.
- To study the root-initiation in different types of cuttings of Guava.

MATERIALS AND METHODS

The research studies were carried out at Tarnab Agricultural Research Station, Peshawar, during the year 2001-2002.

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Effect of Different Growth-Regulators and Types of Cuttings on Rooting of Guava (*Psidium guajava* L).

a) Preparation of Cuttings

Semi hard wood cuttings of guava was taken from about 1 to 1 1/2 year old uniform guava branches in the month of August. The size of cuttings was 5 to 6 inches long, having 2 to 3 buds. Three types of cuttings were prepared i.e. hard wood, semi hard-wood and soft wood. The hard wood cutting was prepared from basal portion of the branches, having one year old matured wood, while the semi hard wood cutting was prepared from the mid portion having ribs, and the soft wood cuttings was prepared from terminal portion of current growth.

b) Application of Hormones/Method of Solution

Different concentrations of paclobutrazol were prepared according to the formula i.e. 1 mg of growth-regulator in 1 liter of water, to make 1 ppm of solution (Hortman and Kester, 1960).

c) Treatments

Basal ends of cuttings (3-4 cm) were dipped in solution for about 5 minutes, before planting. Then the treated cuttings were planted in well prepared soil at a depth of 6-8 cm. The concentrations of all the growth regulators were kept at 3000 ppm. For preparation of 3000 ppm of IBA and NAA solution, three grams of each chemical were taken and were dissolved in 50 percent ethanol, and then distilled water was added to make the required volume.

Factor 1

Control

- T1 → 3000 ppm solution of paclobutrazol
 T2 → 3000 ppm solution of IBA
 T3 → 3000 ppm of NAA

Factor 2

- C1 → Hardwood cutting
 C2 → Semi hard wood cutting
 C3 → Softwood cuttings

The cutting was planted on August 20, in plastic tube having propagation-media of sand, silt and Farmyard Manure in 1: 1: 1 ratio. After planting in plastic, full irrigation was given with a sprinkler. The plastic tube was then covered with a polythene sheet to protect them from desiccation. The experiment was laid out in RCBD design, with two factors and three replications. Twenty cuttings per treatment were used.

RESULTS AND DISCUSSION

Growth regulators and types of cutting had no significant effects on number of days to bud-sprouting. Maximum days were taken by the semi hardwood cutting, treated with IBA (27.33), while minimum days (17.68) was taken by semi hardwood cuttings treated with NAA (Table-1). The reason for non-significant effect of different growth-regulators and types of cuttings may be, that the applied growth-regulators may not have direct effect on the shoot development.

Sprouting Percentage

Sprouting percentage was significantly ($p \leq 0.05$) affected by different growth-regulators and types of cuttings. Maximum sprouting (71.22%) was noticed in softwood cutting treated with paclobutrazol and minimum of sprouting (53.33%) was observed in control (Table-2). The cuttings which were selected for the experiment had conform growth, size and age in each type. Moreover, they may have enough food-material to sprout without any significance differences. The research food-material in the cutting may be utilized

Table - 1: Effect of Various Growth-Regulators and Types of Cuttings on Number of Days to Bud-Sprouting in Guava (*Psidium guajava* L.)

Growth Regulators (ppm)	Types of Cuttings			Mean
	Hardwood	Semi Hardwood	Softwood	
IBA	25.67 a	27.33 a	24.33 a	25.78
NAA	27.00 a	17.68 b	23.00 a	22.56
Paclobutrazol	23.33 a	24.00 a	23.67 a	23.67
Control	23.00 a	23.00 a	26.33 a	24.11
Mean	24.75	23.00	24.33	

Note: Means followed by the same letter are not statistically different from each other at 5% level of probability.

Table - 2: Effect of Various Growth-Regulators and Different Types of Stem-Cutting on the Sprouting Percent of Guava (*Psidium guajava* L.)

Growth Regulators (ppm)	Types of Cuttings			Mean
	Hardwood	Semi Hardwood	Softwood	
IBA	56.67	58.33	61.67	58.89 a
NAA	48.33	59.33	63.67	57.11 a
Paclobutrazol	57.33	55.33	71.00	61.22 a
Control	33.33	46.67	53.33	44.44 b
Mean	48.92 b	54.92 ab	62.42 a	

Note: Mean followed by the same letter are not statistically different from each other at 5% level probability.

as source or sink (new growth) because at this stage they had not root for uptake of the nutrients.

Number of Leaves/Plant

Number of leaves per plant was significantly ($p \leq 0.05$) affected by different types of guava-cuttings and the interaction between different of types of cutting and growth regulators. Maximum number of leaves (11.43) was observed in soft wood cutting in control, while minimum number of leaves (7.33) was noted in soft wood cuttings treated with NAA. (Table-3). The number of leaves per plant was significantly affected by different types of cutting, while the different growth-regulators and the interaction between different types of cutting and growth-regulators had no significant effect on

number of leaves (Table-4). The number of leaves per plant was more in soft wood cuttings as compared to other type of cutting, also produced significantly more roots as compared to other types.

Number of Branches/Plant

Maximum number of branches (3.44) was observed in softwood cutting with paclobutrazol, while minimum number of branches (1.68) was observed in control. The increase in the number of shoots in soft wood cutting may be because auxins are produced in abundance in growing regions (Baloch, 1994), which may enhance the growth in the softwood, as compared to hard wood and semi hardwood cuttings. Secondly, the larger number of branches with paclobutrazol may

Table - 3: Effect of Various Growth-Regulators and Types of Cuttings on Number of Levels/Plant in Guava (*Psidium guajava* L.)

Growth Regulators (ppm)	Types of Cuttings			Mean
	Hardwood	Semi Hardwood	Softwood	
IBA	00.00	00.00	10.22 a	3.41
NAA	00.00	00.00	7.33 b	2.45
Paclobutrazol	00.00	00.00	11 a	3.67
Control	00.00	00.00	11.43 a	3.81
Mean	00.00	00.00	10 a	

Note: Mean followed by the same letter are not statistically different from each other at 5% level of probability.

Table - 4: Effect of Various Growth-Regulators and Types of Cuttings on Number of Branches/Plant in Guava (*Psidium guajava* L.)

Growth Regulators (ppm)	Types of Cuttings			Mean
	Hardwood	Semi Hardwood	Softwood	
IBA	00.00	00.00	3 ab	1.0 a
NAA	00.00	00.00	2.88 ab	0.96 a
Paclobutrazol	00.00	00.00	3.44 a	1.15 a
Control	00.00	00.00	1.68 c	0.56 b
Mean	00.00	00.00	2.75 a	

Note: Mean followed by the same letter are not statistically different from each other at 5% level probability.

Effect of Different Growth Regulators and Types of Cuttings on Rooting of Guava (*Psidium guajava* L.).

Table - 5: Effect of Various Growth-Regulators and Types of Cuttings on Root-Length (cm) in Guava (*Psidium guajava* L.)

Growth Regulators (ppm)	Types of Cuttings			Mean
	Hardwood	Semi Hardwood	Softwood	
IBA	00.00	00.00	6.26 c	2.08 bc
NAA	00.00	00.00	12.81 a	4.27 a
Paclobutrazol	00.00	00.00	9.54 b	3.18 ab
Control	00.00	00.00	4.97 c	1.66 c
Mean	00.00	00.00	8.39 c	

Note: Mean followed by the same letter are not statistically different from each other at 5% level of probability

be because of the fact that paclobutrazol inhibits the gibberellins biosynthesis (anonymous, 1986) resulting in growth suppression.

Root Length (cm)

The longest roots were observed in softwood cuttings treated with NAA and paclobutrazol. Minimum root-length was observed in control (Table-5). The results are in consonance with those of Wahan (1999) who reported that auxins have increasing effect on the root-length. This result is in conformity with that of Lanphear and Meahl (1963) who reported that growth-regulators help in simulating the roots in cuttings when the endogenous and climatic factors are favourable.

Number of Roots

Maximum number of roots (59.66) was found, in softwood cutting treated with IBA at 1000 ppm while minimum number (15.67) of roots were noticed in control. (Table-6). Maximum number of root was recorded in softwood cuttings treated with IBA, while minimum number of roots was observed in control. These results are similar with the finding of Magherni and Sani (1985). They recorded that IBA concentrations

increase the rooting-percentage, and length of the root significantly. They further reported that cutting after treatments with 500-1000 ppm of IBA improves the rooting percentage, number of roots and length of root per cutting. The induction of maximum number of roots in the treated cutting may be due to the fact that cambial activity involved in root-initiation is stimulated by growth-regulators in many species as reported by Digby and Wanerman (1996) in pea.

Survival Percentage

The highest survival of 57.22% was observed in softwood cuttings treated with paclobutrazol, followed by 54.97% in softwood cutting treated with IBA, while softwood cuttings with NAA showed minimum (15.83%) survival (Table-7). The data regarding the survival showed highest value of survival percentage in paclobutrazol and IBA, while minimum was noticed in NAA treated cuttings. The increased survival percentage in paclobutrazol and IBA may be because of more number of roots observed in soft-wood cuttings. The result is similar to Hafeez et al. (1988) who also reported more number of roots in tip cutting of guava with paclobutrazol at 12 ppm, while they observed no rooting within hardwood cutting at any concentration.

Table - 6: Effect of Various Growth-Regulators and Types of Cuttings on Number of Roots of Guava (*Psidium guajava* L.)

Growth regulators (ppm)	Types of Cuttings			Mean
	Hardwood	Semi Hardwood	Softwood	
IBA	00.00	00.00	59.66 c	19.89 a
NAA	00.00	00.00	40.66 d	13.55 ab
Paclobutrazol	00.00	00.00	36.11 d	12.04 b
Control	00.00	00.00	15.67 e	5.220 c
Mean	00.00	00.00	38.03 a	

Note: Mean followed by the same letter are not statistically different from each other at 5% level of probability

Table - 7: Effect of Various Growth-Regulators and Types of Stem Cuttings of Guava on Survival Percentage

Growth Regulators (ppm)	Types of Cuttings			Mean
	Hardwood	Semi Hardwood	Softwood	
IBA	00.00	00.00	54.97	18.32
NAA	00.00	00.00	15.83	5.28
Paclobutrazol	00.00	00.00	57.22	19.07
Control	00.00	00.00	37.58	12.53
Mean	00.00	00.00	41.40	

Note: Mean followed by the same letter are not statistically different from each other at 5% level of probability

Table - 8: Effect of Various Growth-Regulators and Types of Stem Cuttings of Guava on Shoot-Length

Growth Regulators (ppm)	Types of Cuttings			Mean
	Hardwood	Semi Hardwood	Softwood	
IBA	00.00	00.00	8.24	2.75
NAA	00.00	00.00	6.33	2.11
Paclobutrazol	00.00	00.00	4.88	1.68
Control	00.00	00.00	3.83	1.29
Mean	00.00	00.00	5.82	

Note: Mean followed by the same letter are not statistically different from each other at 5% level of probability

Shoot Length

Maximum shoot length (8.24 cm) was observed in softwood cuttings treated with IBA, while minimum (3.83 cm) was noticed in control (Table-8). Results indicate that maximum shoot length was recorded in soft wood cutting treated with IBA, while minimum shoot length was noticed in control. These findings are contradictory with the finding of Mohammad (1998) who reported maximum shoot length of 11.33 cm. However, he obtained the same results at 3000 ppm concentration. The shoot length in case of IBA and NAA was superior than paclobutrazol. The reason for this may be that paclobutrazol inhibited gibberellins biosynthesis (anonymous, 1986), which is a growth-promoting hormone.

CONCLUSIONS AND RECOMMENDATIONS

- Highest survival percentage (57.22) was obtained with paclobutrazol at 1000 ppm of IBA in softwood cutting.
- Paclobutrazol gave better performance than IBA and NAA.
- Result of rooting in softwood cuttings was more encouraging than semi hardwood and hard wood cutting.

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