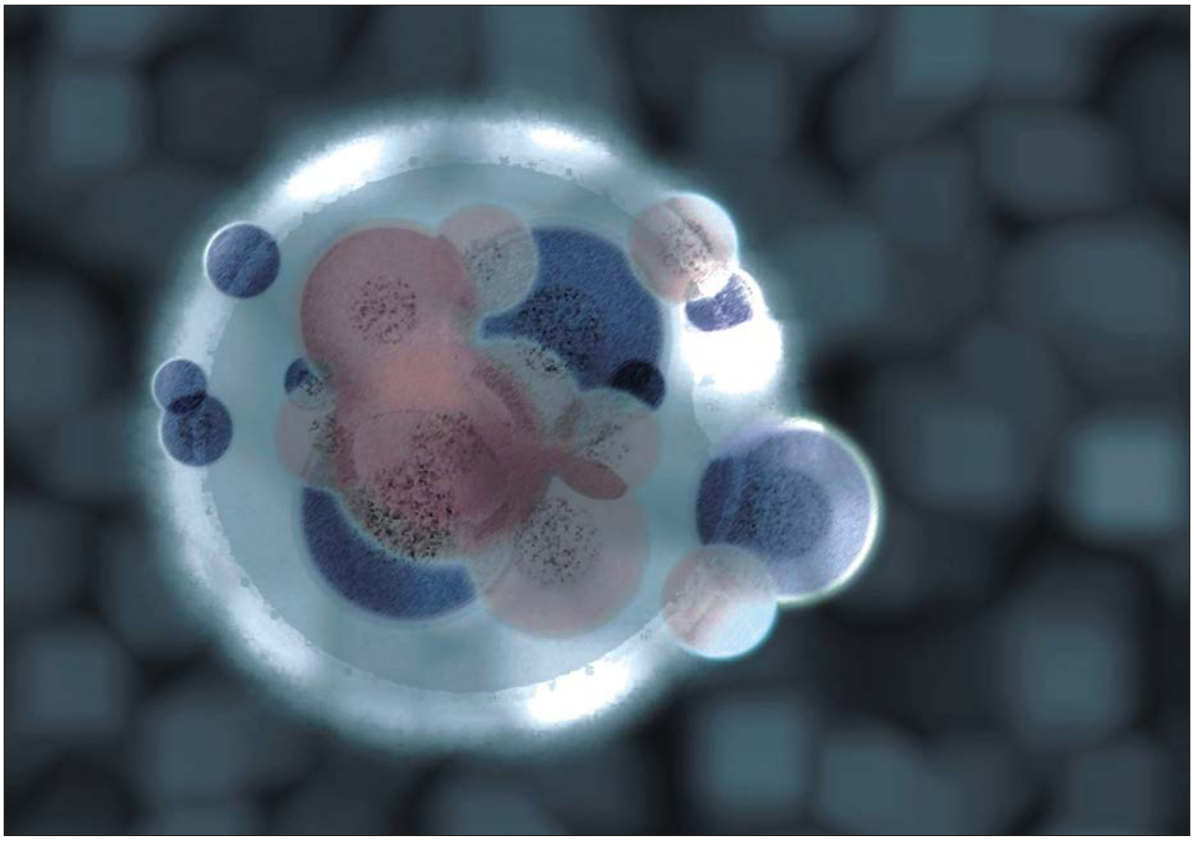

Journal of Biological Sciences

ISSN 1727-3048

science alert

ANSInet
an open access publisher
http://ansinet.com

OnLine Journal of Biological Sciences 1 (4): 184-187, 2001

Rooting Response of Semi-hardwood Cuttings of Guava (*Psidium guajava* L.) to Various Concentrations of Different Auxins

Fazli Wahab, Ghulam Nabi[1], Nawab Ali[2] and Muslim Shah[3]
[1]Agricultural Research Institute, Tarnab, Peshawar Pakistan
[2]Department of Horticulture NWFP Agricultural University, Peshawar Pakistan
[3]Agric. Research FATA, Agricultural Research Institute, Tarnab, Peshawar Pakistan

Abstract: The study was conducted to investigate the influence of Indole Acetic Acid (IAA), Indole Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) each at 0, 1000, 2000, 3000, 4000, 5000 or 6000 ppm on the semi- hardwood cuttings of guava (*Psidium guajava* L.) Cv. Sufida taken in April, 1996. The cuttings were dipped in these solutions for 5 minutes. After treatment, the cuttings were planted and covered with transparent plastic sheet to arrest the water vapours for maintaining humidity. The experiment was laid out in the lathe house of Horticulture Section, Agricultural Research Institute, Tarnab, Peshawar. The auxins had no effect on the number of days to bud sprout whereas, sprouting in itself was significantly increased by IBA at 1000 and 3000 ppm and NAA at 2000 ppm with 79.84, 75.96 and 76.59% respectively. The highest survival (12.50%) was noted in the cuttings treated with IAA at 3000 and 6000 ppm, IBA and NAA both at 6000 ppm. IAA at 3000 ppm significantly increased the number of leaves (16) per cutting. The highest number of roots (23.75) per cutting was recorded in the cuttings treated with IBA at 4000 ppm. The significantly maximum root length (4.13 cm) was noted in the cuttings treated with IAA 3000 ppm. Cuttings treated with IAA at 5000 ppm and IBA at 4000 ppm exhibited significantly highest root weights of 16.25 and 16.62 g respectively.

Key words: Indole acetic acid (IAA), indole butyric acid (IBA), naphthalene acetic acid (NAA), *Psidium guajava* L. and semi-hardwood cuttings

Introduction

Guava (*Psidium guajava* L.), also known as apple of the tropics, belongs to the family Myrtaceae. It is generally propagated through seeds. The usual method is to sow the seeds immediately after extraction, as guava seed loose viability within a short period (Mitra and Bose, 1990). The accumulation of auxins at the base of the cutting trigger normal rooting. To overcome some of the inherent difficulties encountered by the cuttings to root, synthetic auxin application may be helpful, concluded by Bleasdale (1984). Reddy and Singh (1988) reported 87.5 % rooting with 62.86 % survival in hardwood cuttings of guava treated with 2500 ppm solution of IBA. Debnath and Maiti (1990) found that cuttings taken from decapitated guava trees dipped in 2500 ppm IBA, gave best rooting in Cv.Baruipur. Prasad *et al.* (1988) obtained 98% rooting in the hardwood cuttings of guava treated with IBA at 2500 ppm. Poor success in hardwood cuttings and 81.4 % rooting was obtained in semi-hardwood cuttings of guava treated with 2500 ppm IBA + 10 ppm Alpha-Naphtholas, observed by Kilnay and Gabr (1986). Khattak *et al.* (1983) in an experiment with semi-hardwood cuttings found 42.50 and 35.00 % rooting in IBA at 9000 and 6000 ppm respectively. The highest number of roots in their study was noted in IBA at 3000 ppm and 9000 ppm while the maximum root length was obtained in IBA at 3000 and 6000 ppm respectively. Wally *et al.* (1981) reported highest rooting (40 %) in guava hardwood cuttings with 5000 ppm IBA. Similar results were noticed by Tready (1983) with same concentration of IBA. Pereira *et al.* (1983) recorded 70 % rooting with 2 nodes + 4 leaves guava cuttings treated with 2000 ppm NAA. Debnath and Maiti (1990) reported significantly lower responses of the guava cuttings taken from decapitated plants to various doses of NAA and IAA as compared to the best results obtained in IBA treatments. Keeping in view the importance of guava propagation from cuttings and the role of auxins in inducing the roots in cuttings, this study was initiated at the Agricultural Research Institute, Tarnab, Peshawar in collaboration with the Department of Horticulture, NWFP Agricultural University, Peshawar. The main aim of the study was to investigate the rooting response of semi-hardwood cuttings of guava Cv.Sufida to various concentrations of three different auxins, like Indole Acetic Acid (IAA), Indole Butyric Acid (IBA), and Naphthalene Acetic Acid (NAA).

Materials and Methods

The study was conducted at the Lathe House of the Horticulture Section, Agricultural Research Institute Tarnab, Peshawar, during spring, 1996. Land was prepared for plantation of cuttings one week before. Thick layer of canal silt about 3 cm was mixed with one year old Farm yard manure at the rate of 5 kg meter^{-2} in the plots for better aeration. Semi-hardwood (Current year growth after flush of spring) cuttings of guava Cv. Sufida were taken from the orchard. The cuttings were of uniform size, 25 cm long and 0.5 cm thick, having at least four buds and three leaves.

Indole acetic acid (IAA), Indole butyric acid (IBA), and Naphthalene acetic acid (NAA) each with 1000, 2000, 3000, 4000, 5000, and 6000 ppm concentrations were applied. The basal end of each cutting (2.5 - 3.0 cm) was immersed in the desired solution for 5 minutes before planting in the field. The untreated (Control) cuttings were dipped in only deionized water for five minutes. After treatment with specified concentration of auxins, the cuttings were planted on the raised beds (20 cm above the soil surface) in slanting position in the usual manner (8-10 cm deep and 30 cm apart) in Randomized Complete Block Design with four replications. The beds were covered properly with transparent polyethylene sheets, in order to arrest proper humidity inside the plastic. Immediately after planting of the cuttings, the experimental plots were irrigated. Second irrigation was applied one week after plantation of the cuttings. Later on regular irrigation was given accordingly. Hoeing and weeding was done 20 days after plantation. Constant efforts were made to root out the

spring weeds from the experimental area.
The following parameters were studied during the course of the study. Number of days to buds sprouting, sprouting percentage, survival percentage, number of leaves per cutting, number of roots per cuttings, root length and root weight.

Results

The mean number of days to bud sprout in different auxins, their concentration levels and the interaction between auxins and their concentration levels were not significantly different at 5% level of significance (Table 1).
Significantly higher sprouting was obtained in IBA at 1000, 3000 ppm and NAA at 2000 ppm concentrations respectively. While poor sprouting was noticed in IAA at 3000, 6000 ppm, IBA at 6000 ppm and NAA at 6000 ppm treatments with 46.25, 48.70 and 48.56% respectively (Table 1).
Among the IAA treatments 65.00 % sprouting was obtained in 4000 ppm as compared to the lowest 46.25 % observed in 3000 ppm. While IBA treatments were found the most effective among the auxins for increasing sprouting in the semi-hardwood cuttings of guava. The sprouting response of the cuttings to the higher concentrations level of NAA was very little (Table 1).
Different auxins had no significant effect on the survival of the cuttings at 5% level of significance, however, the interaction between auxins and their concentration levels showed highly significant variation. The highest mean survival was observed in IAA at 3000, 6000 ppm, IBA at 6000 ppm and NAA at 6000 ppm treatments, while the lowest survival was obtained in IAA at 2000, 4000, 5000 ppm, IBA at 2000, 3000, 5000 ppm and NAA at 3000, 4000 ppm concentrations (Table 2).
The number of leaves per cutting were significantly increased in different auxins, their concentration levels and the interaction between auxins and their levels at 5% level of significance. Significantly higher number of leaves per cutting were noticed in IAA at 3000 ppm while the lowest number of leaves per cutting were found in IAA at 4000 ppm and IBA at 2000, 5000 ppm concentrations. The number of leaves per cutting were significantly increased in the IAA treatments while the cuttings exhibited meager response to other auxins treatments.
Auxins had no significant effect on increasing the number of roots in the cuttings however, the interaction between auxins and their concentration levels showed highly significant variation at 5 % level of significance. Number of roots per cutting were increased in IBA at 4000 ppm as compared to the lowest number of roots per cutting induced in IBA 1000 ppm. Among the IAA treatments the highest number of roots per cutting were found in 5000 ppm as compared to the lowest number of roots per cutting in 2000 ppm concentration. The number of roots per cutting were not significantly increased by the NAA treatments (Table 3).
A highly significant variation was noticed as regards the root length in different auxins, their concentration levels and the interaction between auxins and their levels at 5% level of significance. Significantly highest root length was found in IAA at 3000 ppm as compared to the smallest root length obtained in IBA at 4000 ppm. The cuttings displayed a mediocre response to the IBA and NAA treatments as regards the increase in the root length is concerned (Table 4).
The semi-hardwood cuttings of guava showed a non-significant increase in root weight while their concentration levels and the interaction between auxins and their concentrations exhibited significant variation at 5% level of significance. The highest mean root weights 16.25 and 16.62 g were observed in IAA at 5000 ppm and IBA at 4000 ppm while the least roots weight 6.71, 5.91 and 6.11 g were observed in IAA at 1000, 2000 ppm and IBA at 2000 ppm respectively. Among the IAA treatments the lowest root weights were discovered in 1000 and 6000 ppm. In the case of IBA treatments the lowest root weight was obtained in 2000 ppm. While the response of the cuttings to NAA treatments was significantly lower with the only exception of 1000 ppm with 13.27 g root weight (Table 5).

Discussion

It is evident from the results that auxins application has no effect on the number of days to bud sprout in other words auxins application to the semi-hardwood cuttings of guava may not influence the number of days to bud sprout. The reason for this phenomenon may be, the applied auxins may not have direct effect on the shoot development as described by many researchers (Hartman *et al.,* 1981; Bleasdale, 1984) supposed that these hormones are responsible for inducing roots and secondly the stored food materials (Carbohydrate) in the cuttings provide sufficient amount of food for bud sprouting. However at some latter stages after development of roots the auxins may have indirect effect on the sprouting which needs to be explored.
A significant effect on the increase in sprouting was observed in the semi hardwood cuttings of guava. IBA at 1000 and 3000 ppm while NAA at 2000 ppm were found best for sprouting increase in of the cuttings. Similar results were reported by many scientists (Khattak *et al.,* 1983; 1974; Reddy and Singh, 1988; Debnath and Maiti, 1990; Ahmad, 1963 etc.). Bud sprouting is mainly attributed to the stored carbohydrate in the cuttings, used for sprouting, however, with auxins application to the cutting and subsequent increase in the rooting, as the hypothesis of the study was, may result in the increase of sprouting, this indirect effect of auxin on sprouting highlights the role of certain materials produced in the roots, responsible for sprouting.
Auxin application to the semi-hardwood cuttings of guava significantly increased survival of the cutting. The highest survival of 12.50% was obtained in IAA at 3000 and 6000 ppm, IBA and NAA at 6000 ppm however, Reddy and Singh (1988) reported 62.86 % survival. The difference in the results may be due to many reasons, but the varied experimental conditions may be the ultimate explanation. The survival of the sprouted cuttings may be directly linked to the regeneration of adventitious roots in the cuttings. Auxins role in inducing roots in the cuttings as described by many researchers is in consistency with the results of the study.
Auxins application to the semi-hardwood cuttings of guava has a significant effect on increasing the number of leaves which are one of the production sites of natural auxin in the plants beside the main activities of photosynthesis, respiration and transpiration. The highest number of leaves per cutting noticed in IAA at 3000 ppm in the study. The increased roots in the cuttings due to auxins application may have necessitated the increased activity of photosynthesis and other activities carried out in the leaves, which in turn may have resulted in the increase of leaves in the cuttings.
The results reveal that auxin application to the semi-hardwood cuttings of guava will significantly increase the number of roots in the cuttings. Highest number of roots found in IBA at 4000 ppm, followed by IAA at 5000 ppm, however, the response of the cuttings was not significant. The results of the study are in conformity with the findings of Khattak *et al.* (1983), however, they obtained the same results with IBA at

Table 1: Influence of various auxins on the time taken to bud sprout (A) and percent bud sprouting (B) of semi-hardwood cuttings of guava

A)	Time Taken To Bud Sprout (Days)			
Concentration	IAA	IBA	NAA	Mean
Control	15.00	14.50	13.50	14.33
1000 ppm	14.25	13.00	14.75	14.00
2000 ppm	13.25	14.50	15.00	14.25
3000 ppm	13.50	13.75	13.00	13.42
4000 ppm	15.50	14.00	14.50	14.00
5000 ppm	15.00	13.25	14.00	14.08
6000 ppm	14.00	14.00	14.00	14.00
Mean	14.07	13.85	14.11	

Significance of type of Auxin: ns Significance of concentration: ns Significance of Interaction: ns

(B)	Bud Sprouting percentage			
Control	53.42 gh	63.76 c	70.00 b	62.39 b
1000 ppm	59.14 eg	79.84 a	69.17 bc	69.38 a
2000 ppm	54.23 fg	56.42 fg	76.59 a	62.41 b
3000 ppm	46.25 l	75.96 a	64.17 be	62.12 b
4000 ppm	65.00 be	66.67 bd	63.29 de	64.99 b
5000 ppm	60.01 ef	69.17 bc	67.00 bd	65.39 b
6000 ppm	48.70 hi	48.95 hi	48.56 hi	48.73 c
Mean	55.25 b	65.82 a	65.54 a	

Significance of type of Auxin:** Significance of concentration: ** Significance of Interaction: **

Means showing common letter/letters are not significantly different at 5 % level of significance. Highly significant denoted by ** and not significant is denoted by ns, CV8.91 % for time taken to bud sprout CV6.67 % for bud sprout percentage.

Table 2: Influence of various auxins on survival percentage and number of leaves of semi-hardwood cuttings of guava

A)	Survival percentage			
Concentration	IAA	IBA	NAA	Mean
Control	10.00 b	10.00 b	10.00 b	10.00 b
1000 ppm	10.00 b	10.00 b	10.00 b	10.00 b
2000 ppm	7.50 c	8.00 c	10.00 b	8.50 c
3000 ppm	12.50 a	8.00 c	7.50 c	9.33 b
4000 ppm	7.50 c	10.00 b	7.50 c	8.33 c
5000 ppm	7.50 c	7.50 c	10.00 b	8.33 c
6000 ppm	12.50 a	12.50 a	12.50 a	12.50 a
Mean	9.64	9.43	9.64	

Significance of type of Auxin: ns Significance of concentration: ** Significance of Interaction: **

B)	Number of leaves			
Control	12.50 b	8.00 de	10.50 c	10.33 ab
1000 ppm	12.50 b	10.00 c	10.50 c	10.00 a
2000 ppm	9.50 cd	7.50 e	10.50 c	9.17 cd
3000 ppm	16.00 a	8.00 de	8.00 de	10.67 a
4000 ppm	7.50 e	9.50 cd	8.00 de	8.33 d
5000 ppm	12.50 b	7.50 e	10.50 c	10.17 ac
6000 ppm	9.50 cd	9.50 cd	9.50 cd	9.50 bc
Mean	11.43 a	8.57 c	9.64 b	

Significance of type of Auxin: ** Significance of concentration: ** Significance of Interaction: **

Means showing common letter/letters are not significantly different at 5 % level of significance. Non-significant is denoted by ns and highly significant are denoted by ** CV10.08 % for survival percentage, CV12.73 % for Numbers of leaves per plant.

Table 3: Influence of various auxins on number of roots in semi-hardwood cuttings of guava

Concentration	Number of roots per cutting			
	IAA	IBA	NAA	Mean
Control	10.50 fh	17.00 c	10.50 fh	12.67 bc
1000 ppm	11.00 eg	7.75 h	19.25 bc	12.67 bc
2000 ppm	8.75 gh	14.00 d	10.75 eg	11.17 cd
3000 ppm	12.25 df	10.75 eg	17.50 bc	13.50 b
4000 ppm	13.50 de	23.75 a	11.25 dg	16.17 a
5000 ppm	20.00 b	11.00 eg	8.75 gh	13.25 b
6000 ppm	9.75 fh	9.75 fh	11.25 dg	10.25 d
Mean	12.25	13.43	12.75	

Significance of type of Auxin: ns Significance of concentration:** Significance of Interaction: ** LSD 5% for concentrations = 1.656

LSD 5% for interaction 1.868

Means showing common letter/letters are not significantly different at 5 % level of significance. Non-significant is denoted by ns CV15.83 %

Table 4: Influence of various auxins on root length of the semi-hardwood cuttings of guava

Concentration	IAA	IBA	NAA	Mean
Control	2.58 cg	2.74 ce	3.31 b	2.88 ab
1000 ppm	2.76 ce	2.08 hi	2.62 cg	2.49 cd
2000 ppm	2.36 ei	2.08 hi	2.71 cf	2.38 cd
3000 ppm	4.13 a	2.51 dh	2.21 gi	2.95 a
4000 ppm	1.93 i	2.88 bd	2.31 ei	2.37 d
5000 ppm	2.99 bc	2.24 fi	2.76 ce	2.66 bc
6000 ppm	2.62 cg	2.62 cg	2.62 cg	2.62 bd
Mean	2.77 a	2.45 b	2.65 a	

Significance of type of Auxin: ** Significance of concentration: ** Significance of Interaction: **

Means showing common letter/letters are not significantly different at 5 % level of significance. Significant at 5 % level of significance is denoted by ** , CV13.16%

Table 5: Influence of various auxins on root weight of the semi-hardwood cuttings of guava

Concentration	IAA	IBA	NAA	Mean
Control	7.80 fi	11.70 bd	7.35 gi	8.95 c
1000 ppm	6.72 i	12.47 bc	13.27 b	10.82 ab
2000 ppm	5.97 i	6.12 I	9.57 bg	7.22 de
3000 ppm	8.52 ei	7.35 gi	10.15 cf	8.67 cd
4000 ppm	9.45 dh	16.62 a	10.72 be	12.26 a
5000 ppm	16.25 a	7.52 fi	7.87 fi	10.55 b
6000 ppm	6.82 hi	6.82 hi	6.82 hi	6.82 e
Mean	8.79	9.80	9.39	

Significance of type of Auxin: ns Significance of concentration: ** Significance of Interaction:**

Means showing common letter/letters are not significantly different at 5 % level of significance.Non-significant is denoted by ns and Highly significant is denoted by** , CV19.97 %.

3000 and 9000 ppm.

Root length was significantly increased by the application of auxins to the semi-hardwood cuttings of guava. The maximum root length (4.31 cm) was obtained in IAA at 3000 ppm. Khattak *et al.* (1983) noted 3.2 and 2.2 cm root length in IBA at 3000 and 6000 ppm respectively. The results reflect that all the three auxins have little effect on the root length of the semi-hardwood cuttings of guava.

The application of auxins have increased the root weight of the semi-hardwood cuttings of guava. Treating the cuttings with IAA and IBA at 4000 ppm were found effective for increasing the root weight respectively. Increase in the root weight of the semi-hardwood cuttings of guava as influenced by the application of auxins may primarily be due to the more number of leaves produced die to the application of auxins.

References

Ahmad, R., 1963. Propagation of guava by cuttings. West Pak. J. Agric. Res., 1: 51-91.

Bleasdale, J.K.A., 1984. Plant Physiology in Relation to Horticulture. 2nd Edn., Macmillan Publishing Co., London, pp: 92-95.

Debnath, G.C. and S.C. Maiti, 1990. Effect of growth regulators on rooting of soft wood cuttings of guava (*Psidium guajava* L.) under mist. Haryana J. Hortic. Sci., 19: 79-85.

Hartman, H.T., W.J. Flocker and A.M. Korfranek, 1981. Plant Science: Growth, Development and Utilization of Cultivated Plants. Prentice-Hall, Englewood Cliffs, New Jersey, USA., pp: 617-618.

Khattak, M.S., H. Inayatullah and S. Khan, 1974. Propagation of guava from semi-hardwood cuttings. Frontier J. Agric. Res., 8: 81-82.

Khattak, M.S., H. Inayatullah and S. Khan, 1983. Propagation of guava (*Psidium guajava* L.) from semi hard wood cuttings. Frontier J. Agric. Res., 8: 87-90.

Kilnay, O.A. and M.F. Gabr, 1986. Propagation of seedless guava trees by cuttings. Hortic. Abst., 1988: 05307-05307.

Mitra, S.K. and T.K. Bose, 1990. Guava. In: Fruits, Tropical and Sub-Tropical. Bose, T.K. (Ed.). Naya Prokash, Calcutta, India, pp: 280-301.

Pereira, F.M., A.A.P. Oioli and D.A. Banzatto, 1983. Rooting of different types of guava leafy cuttings *Psidium guajava* L. under mist. Hortic. Abst., 1986: 00688-00688.

Prasad, J., A. Rabbani and R.A. Ram, 1988. Rooting of hardwood cuttings of guava *Psidium guajava* L. through bottom heat. Prog. Hortic., 20: 20-23.

Reddy, K.M. and R.N. Singh, 1988. Efficacy of plastic-house in propagation of guava *Psidium guajava* L. through hardwood cuttings. Indian J. Agric. Sci., 58: 81-82.

Tready, M.T., 1983. Effect of IBA on kiwifruit and guava hardwood cuttings. Horticulture, 53: 3193-3193.

Wally, Y.A., E.L. Hamady, M.M. Boulos and N.M. Abu-Amara, 1981. Rooting experiments on guava using hardwood stem cutting. Egypt. J. Hortic., 8: 77-87.