JOURNAL OF AGRICULTURE & SOCIAL SCIENCES
1813–2235/2006/02–1–13–16
http://www.fspublishers.org

Effect of Some Auxins on Growth of Damask Rose Cuttings in Different Growing Media

MUHAMMAD SOHAIL KHAN[1], RAHMAT ULLAH KHAN† AND KASHIF WASEEM‡
Horticulture Section, Agricultural Research Institute, Ratta Kulachi, D.I. Khan – Pakistan,
†*Arid Zone Research Institute, D.I. Khan – Pakistan*
‡*Department of Horticulture, Faculty of Agriculture, Gomal University, D.I. Khan, Pakistan*
[1]Corresponding author's email: sohail_agri@yahoo.com

ABSTRACT

The present study was designed to determine the rose cuttings response to auxins i.e. indole-3-acetic acid (IAA) and naphthalene acetic acid (NAA) at 0, 25, 50, 75 and 100 mg L^{-1} concentrations in three different growing media. Both had a significant effect on all sprouting and growth parameters. Maximum bud sprouting (78.76 %), bud spread (11.32 cm) and shoots length (13.68 cm) in damask rose cuttings were recorded at 50 mg L^{-1} NAA while maximum days to bud sprouting (13.11) and number of leaves (7.37) were recorded at 75 mg L^{-1} NAA. Of these, NAA was superior to IAA for its strong synergistic effect on all growth parameters. The optimum level of NAA was found in the range of 50 and 75 mg L^{-1}, while no such effect was evident of IAA, nonetheless as all growth parameters were linearly increased up to the highest concentrations of IAA i.e. 100 mg L^{-1}. Concerning growing media, leaf mould was the most effective in promoting growth of rose cuttings followed by soil + leaf mould and soil media.

Key Words: Auxins; *Rosa damascena* Mill; Growth; Cuttings; Media

INTRODUCTION

Rose, the queen of flowers, is favoured for its beauty and many other uses like production of petals, making rose oil (*attar*), rose water (*ark-e-gulab*), rose wine, rose marmalade (*gulkand*), rose jam, rose crystallized petals, rose honey, extraction of perfumes, extraction of vitamin C from hips, for medicinal uses and for sale as cut flowers (Khan & Khan, 1991).

In agriculture the production of plant species through sexual as well as vegetative means is of prime importance to continuity of generation. Most of the plant species perpetuate through sexual method of propagation, which is easy and plays a vital role in the development of new species that are best suited to the changing environment. Each individual resulting from sexual reproduction usually has a unique combination of genes. There are scores of plant species that are not only hard to be propagated sexually but also show complexities and produce undesirable characters if propagated through sexual means. Vegetative propagation therefore, is the most vital and sole method to reproduce these plant species still having desirable characters. These plant species are propagated true to type from somatic cells through cutting, budding, grafting, layering etc. Among these the use of stem cuttings is the most easy and common method for growing roses (Anderson & Woods, 1999).

The establishment and growth rate of cutting depends upon many factors like season of cutting, age and portion of the branch, growth media, moisture and nutrient status. Keisling and Kester (1979) concluded that poor rooting of the cutting has been attributed to marginal condition of growing media. Provision of optimal growing conditions and proper timing may enhance the establishment and growth of cutting. In addition, the use of plant growth regulators also plays a pivotal role in influencing different plant processes comprising mostly of growth, differentiation and development e.g. rooting of cutting, root growth, flowering, aging, prevention or promotion of stem elongation, color enhancement of fruit etc (Hobbie, 1998). Therefore, many kinds of chemicals have been used with the aim to induce root formation in species which are difficult to propagate or increase the number and extent of roots in others that develop slowly. Synthetic root promoting chemicals that have been found most reliable in stimulating adventitious root production in cuttings are the auxins i.e. indole acetic acid (IAA), naphthalene acetic acid (NAA) and indole butyric acid (IBA) (Arteca, 1996). These chemicals are available in commercial preparations, like talc or concentrated liquid formulations and can be diluted with water to the proper strength.

Keeping in view the role of plant growth regulators and growing media, indole-3-acetic acid (IAA) and naphthalene acetic acid (NAA) were taken to evaluate their effect on the growth of rose cuttings in three growing media i.e. soil, leaf mould and soil + leaf mould under the agro-climatic conditions of D.I. Khan.

MATERIALS AND METHODS

Present research study was conducted at the research farm of Arid Zone Research Institute (AZRI) D.I. Khan during 2004. Indol-3-acetic acid (IAA) and naphthalene acetic acid (NAA) and three growing media i.e. soil alone; leaf mould and soil + leaf mould mixture (1:1) were used for this purpose. The growth regulator solutions were prepared in ethylated distilled water at the rate of 25, 50, 75, and 100 mg L^{-1} according to the formula given by Hartmann and Kester (1983), along with control (distilled water only).

Polythene bags (5 x 15 cm^2), were filled up with 650 g each of the above mentioned growing media. Before initiating the experiment all the three growing media were analyzed for their physico-chemical characteristics (Table I). The experiment was laid out in randomized complete block design (RCBD) with split plot arrangements and three replications. Diseases free uniform semi-hardwood rose cuttings (15 cm long) were applied with dilute solution of growth regulators using dip method (Hartmann & Kester, 1983) for 24 hours at room temperature. They were then sticked in respective pre-assigned growing media. The bags were placed in open air. Irrigation water was applied for 24 h by overhead sprinklers during the rooting period. At the end of spring season, data was recorded on days taken to bud sprouting, bud sprouting percentage, bud spread (cm), number of leaves and shoot length (cm). Recorded data were analyzed statistically using analysis of variance technique (ANOVA) and means were compared by Duncan's multiple range test (Steel & Torrie, 1980).

RESULTS AND DISCUSSION

Days taken to bud sprouting. This attribute was significantly affected with growth regulator application (Table II). Minimum number of days to sprouting (9.11) was noted for control cuttings, indicating the strong effect of growth regulators in delaying the bud sprouting. The maximum days to sprouting (13) were observed in the treatments receiving 75 mg L^{-1} NAA. The delay in sprouting on account of growth regulator application is plausible due to higher metabolic activity causing a greater flow of metabolites to the growing bud differentiation that prolonged the bud sprouting period while the earlier bud sprouting in control is perhaps due to the direct sprouting of already differentiated buds without any further differentiation. These results are in conformity with Sun & Chen (1998) and Khan *et al.* (2004).

The growing media had significant effect (P<.05) on the number of days to bud sprouting (Table III). The days to bud sprouting was significantly delayed in the soil media (12.19) whereas earlier sprouting i.e. 11.44 and 11.56 appeared in leaf mould and soil + leaf mould respectively. This is attributable to the better water holding capacity (WHC) and availability of sufficient plant nutrients in these media that facilitated the translocation of solutes towards for sprouting. These findings are in line with Uma and Gowda (1991).

The interaction effect of different treatments (various growth regulators and its levels) and growing media was non-significant (P>0.05). However, maximum 14 days were taken by the buds that received 100 mg L^{-1} NAA in soil media for initial sprouting. Generally the sprouting was delayed in soil media at all treatments. On the other hand the leaf mould media under no auxins application was better by taking the minimum days (8.33) to sprout (Table IV).

Table I. Physico-Chemical Characteristics of Different Growing Media

Value in Growing Media Property	Soil	Leaf mould	Soil + Leaf mould
AB-DTPA extractable P (mg kg^{-1})	7.68	11.16	9.10
Ammonium acetate extractable K (mg kg^{-1})	143	185.4	154.6
NH_4-N (mg kg^{-1})	7.87	10.50	9.62
NO_3-N (mg kg^{-1})	7.25	64.7	27.12
N (%)	0.078	0.796	0.306
Organic matter (%)	1.58	21.66	11.52
pH	8.53	8.13	8.38
EC (dS m^{-1})	0.12	0.22	0.15

Sprouting percentage. Increased concentrations of growth regulators increased this attribute significantly (Table II). The highest sprouting percentage was recorded when NAA was applied at 50 and 75 mg L^{-1}, whilst the lowest sprouting was observed in control treatments. These results are in line with the findings of Younas and Riaz (2005). Data further revealed that the sprouting percentage continued to increase by IAA up to, 100 mg IAA L^{-1}. However in case of NAA the sprouting percentage first increase at 50 mg L^{-1} remained constant at 75 mg L^{-1} and then showed a drastic decrease at 100 mg L^{-1}. The data suggested that stronger promoting effect of NAA on bud sprouting as compared to IAA was presumably due to better performance of the former in development. Likewise, effect of growing media had significant effect (P<0.05) on the sprouting cuttings in this study (Table III). The highest sprouting was observed in leaf mould, while it was the lowest in soil only. This was attributed to the maximum amount of organic matter and essential plant nutrients in the leaf mould followed by soil + leaf mould indicating their availability for metabolic activities (Rahman & Ishtiaq, 1996). Interactive effect of different treatments (growth regulators and growing media) affected significantly the sprouting percentage (Table IV). The data showed that the sprouting was comparatively higher in NAA at 50 and 75 mg L^{-1} when the cuttings were stuck in leaf mould media followed by 100 mg L^{-1} IAA in soil + leaf mould and soil only.

Bud Spread per cutting. Growth regulator applications had a significant effect on the average bud spread per cuttings (Table II). Mean values of bud spread ranged from 6.52 cm to 11.32 cm but NAA at 50 and 75 mg L^{-1} significantly increased it. The lowest bud spread (6.52 cm) was observed in control treatments. Almost similar results have been reported by Tofanelli *et al.* (2002), indicating that the application of growth regulators stimulated the accumulation of dry mass in shoot bud differentiation,

Table II. Effect of Growth Regulator Treatments on Plant Growth Parameters

Plant growth Regulator levels (mg L^{-1})	Days to Bud Sprout	Bud Sprout (%)	Bud Spread (cm)	Number of Leaves	Shoot Length (cm)
T1 = Control	9.1 c	38.1 f	6.51 g	5.35 e	6.30 f
T2 = 25 IAA	10.9 b	46.1 e	7.77 f	5.57 e	7.35 ef
T3 = 50 IAA	11.8 ab	49.6 e	8.44 ef	5.84 de	7.73 de
T4 = 75 IAA	12.1 ab	56.8 d	8.84 de	6.52 bd	8.78 d
T5 = 100 IAA	11.9 ab	72.8 b	10.19 bc	6.94 ab	10.53 c
T6 = 25 NAA	12.0 ab	64.1 c	8.33 ef	6.10 ce	8.95 d
T7 = 50 NAA	11.9 ab	78.8 a	11.32 a	7.28 ab	13.68 a
T8 = 75 NAA	13.1 a	77.5 a	10.71 ab	7.37 a	12.03 b
T9 = 100 NAA	12.8 a	68.0 c	9.59 cd	6.86 ac	10.61 c
LSD at P < 0.05	1.39	4.52	1.03	0.79	1.39

Table III. Effect of Different Growing Media on Plant Growth Parameters

Growing media	Days to Bud Sprout	Bud Sprout (%)	Bud Spread (cm)	Number of Leaves	Shoot Length (cm)
M1 = Soil	12.2 a	59.5 c	8.61 b	6.14 b	8.90 b
M2 = Leaf mould	11.4 b	63.2 a	9.75 a	6.87 a	10.35 a
M3 = Soil + Leaf mould	11.6 b	61.3 b	8.87 b	6.27 ab	9.40 ab
LSD at P $\leq$ 0.05	0.57	1.49	0.51	0.67	1.24

Table IV. Effect of Interaction (Growth Regulator Treatments x Growing Media) on Plant Growth Parameters

Growth Regulator x media	Days to Bud Sprout	Bud Sprout (%)	Bud Spread (cm)	Number of Leaves	Shoot Length (cm)
T1 M1	9.6	41.3 ij	6.43	5.00	5.53 l
T2 M1	11.0	46.0 hj	7.20	5.33	6.75 kl
T3 M1	11.7	47.5 hj	7.87	5.83	7.17 jl
T4 M1	12.0	50.6 gh	8.27	6.00	8.33 gk
T5 M1	12.7	71.8 bd	10.07	7.17	10.33 ch
T6 M1	12.7	59.4 ef	8.00	5.77	9.33 fj
T7 M1	12.3	76.5 b	10.00	6.90	12.30 bd
T8 M1	13.7	75.1 b	9.90	6.77	10.43 cg
T9 M1	14.0	66.8 ce	9.80	6.50	9.90 di
T1 M 2	8.3	33.3 k	6.47	5.42	6.17 kl
T2 M2	10.3	43.3 hj	8.57	5.62	7.54 il
T3 M2	11.3	43.1 hj	8.97	5.83	8.00 hk
T4 M2	12.0	61.5 ef	9.40	7.43	9.47 ej
T5 M2	13.0	74.6 bc	10.17	6.97	11.75 be
T6 M2	11.0	70.4 bd	9.17	6.27	9.50 ej
T7 M2	11.3	85.4 a	13.53	8.40	17.40 a
T8 M2	12.7	84.4 a	11.37	8.33	12.63 bc
T9 M2	13.0	72.6 bc	10.10	7.53	10.73 bg
T1 M3	9.3	39.7 jk	6.63	5.63	7.20 jl
T2 M3	11.3	48.9 hi	7.53	5.75	7.77 il
T3 M3	12.3	58.3 fg	8.50	5.87	8.01 hk
T4 M3	12.3	58.3 fg	8.87	6.13	8.53 gk
T5 M3	10.0	72.0 bd	10.33	6.70	9.51 ej
T6 M3	12.3	62.4 ef	7.83	6.28	8.00 hk
T7 M3	12.0	74.4 bc	10.43	6.53	11.33 bf
T8 M3	13.0	73.1 bc	10.87	7.00	13.03 b
T9 M3	11.3	64.6 df	8.87	6.53	11.20 bf
LSD at P < 0.05	N.S	7.83	N.S	N.S	2.42

N.S = Non significant

which was probably the result of an increase in the metabolic activity in stem cuttings and greater metabolite flow to the growing shoot bud differentiation. Further evaluation of the data indicated that the bud spread increased up to the final concentration i.e. 100 mg IAA L^{-1}. Growing media also enhanced the bud spread significantly (P<.05); maximum (9.75 cm) being in leaf mould, and minimum (8.61 cm) in soil only (Table III). These results are in conformity to the findings of Rafaqat *et al*. (1997), who reported that such media are nutritionally rich and result in substantial leaf or bud spread. The interaction of growing media along with different concentrations of IAA and NAA was (P<.05) among the treatments (Table IV).

Number of Leaves per cutting. The average number of leaves per rose cuttings gradually increased with increase in growth regulator concentration (Table II). It ranged from 5.35 to 7.36 but significantly the maximum number of leaves (7.36) was recorded when the cuttings were treated with 75 mg L^{-1} NAA among the treatments, followed by closely related values of (7.28) and (6.94) in treatments receiving NAA at 50 mg L^{-1} and 100 mg L^{-1} of IAA respectively. The control treatments significantly produced the lowest number of leaves (5.35) per cutting. Increase in leaf number may be due to their significant effect on inducing vigorous rooting system by growth regulators thus enabling the cuttings to absorb more nutrients thereby producing more leaves as reported by Prati *et al.* (1999) and Stancato *et al.* (2003). Nonetheless, NAA was better than IAA in this respect. As regards growth media, the leaf mould appeared to be the best in giving highest number of leaves (6.87) followed by soil + leaf mould (6.27) (Table III). It might be the results of better nutritional stats of these media. Interaction between various levels of growth regulators and growing media was not seen (Table IV).

Shoot Length cutting^{-1} (cm). Average shoot length per cutting differed significantly ($P<.05$) among growth regulators, their concentrations and growth media (Table II). Maximum shoot length per cutting (13.68 cm) was recorded with 50 and 75 mg L^{-1} NAA, while minimum in controls. In this study all the concentrations of NAA proved superior to IAA. The results are in line with Chatfield *et al.* (2000) and Mayer *et al.* (2001). Growing media had significant effect ($P<.05$) on the mean shoot length per cutting (Table III). The maximum average shoot length (10.35 cm) was observed in leaf mould while the minimum in soil only, while there was no significant difference between leaf mould and soil + leaf mould. Research findings showed that the shoot length increased with greater availability of more organic matter in leaf mould a finding in line with Bibhaskumar (2003). The interaction of different treatments (various growth regulators and its levels) and growing media significantly affected the shoot length of rose cuttings (Table IV).

CONCLUSION

Application of both growth regulators and growing media had a significant effect on the growth and development parameters of damask rose. NAA had more strong beneficial effect than IAA on root growth and development. The effective levels of NAA were 50 and 75 mg L^{-1}, while no such conclusion could be drawn for IAA as all growth parameter were linearly increased up to the highest concentration of IAA (100 mg L^{-1}). Regarding growing media, the leaf mould was found superior in terms of its promotive effects on growth and establishment of rose cutting followed by soil + leaf mould.

REFERENCES

Anderson, R.G. and T.A. Woods, 1999. An economic evaluation of single stem cut rose production. *Acta Hort*., 481: 629–34.

Arteca, R.N., 1996. *Plant Growth Substances*. pp. 131–40. Chapman and Hall Inc. New York, USA.

Bibhaskumar, D., 2003. *Life functions of plants. Kalyani's Gardener's Guide*. 1st Ed. pp. 4–5. Kalyani publishers. Ludhiana, India.

Chatfield, S.P., P. Stirnberg, B.G. Forde and O. Leyser, 2000. The hormonal regulation of axillary bud growth in *Arabidopsis*. *Plant J.,* 24: 159–69

Hartmann, H.T. and D.E. Kester, 1983. *Plant Propagation Principles and Practices*, 4th Ed. pp. 321–3. Prentice hall, Inc. England cliffs. New Jersey.

Hobbie, L.J., 1998. Auxin: molecular genetic approaches in Arabidopsis. *Plant Phys. Bioch,* 36: 91–102

Keisling, T.C. and D.E. Kester, 1979. Aluminum and manganese toxicity of rose plants growth in East Texas. *Hort. Sci,* 14: 509–10

Khan, M.A. and A.B. Khan, 1991. Dahlia. *Zarat Nama,* 29: 9–11

Khan, M.A., K. Ziaf and I. Ahmad, 2004. Effect of various hormones and different rootstocks on rose propagation. *Pakistan J. Biol. Sci.,* 7: 1643–6

Mayer, N.A., F.M. Pereira and J.C. Nachtigal, 2001. Propagação do umezeiro (*Prunnus mume* Sieb & Zucc.) por estaquia herbácea. *Revista Brasileira de Fruticultura*, 23: 643–6

Prati, P., F.A.A. Mourão Filho, C.T.S. Dias and J.A. Scarpare Filho, 1999. Estaquia semi-lenhosa: um método rápido e alternativo para a produção de mudas de lima ácida "Tahiti". *Scientia Agricola,* 56: 185–90

Rahman, S. and M. Ishtiaq, 1996. Response of *Jasminum samb*ac cuttings in different soil media. *Sarhad J. Agric,* 12: 409–15

Rafaqat, A.B., M. Ishtiaq and M. Ahmad, 1997. Propagation of *Cestrum nocturnum* cuttings as affected by different soil media and irrigation intervals. *Sarhad J. Agric,* 13: 431–8

Steel, R.G.D. and J.H. Torrie, 1980. *Principles and Procedure of Statistics. A Biometrical Approach.* pp. 232–49. Mc-Graw Hill Book Co. Inc. New York.

Stancato, G.C., F.F.A. Aguiar, S. Kanashiro and A.R. Tavares, 2003. *Rhipsalis grandiflora.* Haw. propagation by stem cuttings. *Scientia Agricola,* 56: 185–90

Sun, Z.F. and L. Chen, 1998. Effect of cut position and plant growth regulators on growth and flowering in cut roses. Qingdao Institute of Agricultural Science, China. *Adv. Hort,* 2: 711–5

Tofanelli, M.B.D., Chalfun, N.N.J., Hoffmann, A., Jr. Chalfun, 2002. Efeito do ácido indolbutírico no enraizamento de estacas de ramos semi-lenhosos de pessegueiro. *Pesquisa Agropecuária Brasileira,* 37: 939–44

Uma, S. and J.V.N. Gowda, 1991. Studies on the effect of pruning, nutrients and their interaction on growth and flowering of rose cv. Super Star, *Mysor J. Agric. Sci.,* 21: 455–60

Younas, A. and A. Riaz, 2005. Effect of Various Hormones and Different Rootstocks on Rose Propagation. *Caderno De Pesquisa Série Biologia,* 17: 111–8

(Received 02 October 2005; Accepted 28 November 2005)