http://www.pjbs.org

PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 6 (24): 2040-2043, 2003
ISSN 1028-8880

Rooting Response of 'Nabali' and 'Improved Nabali' Olive Cuttings to Indole Butyric Acid Concentration and Collection Season

Al-Absi Khalid Mousa
Department of Plant Production, Faculty of Agriculture, University of Mu'tah, Jordan

Abstract: An experiment was carried out to study the influence of five concentrations of Indole butyric acid (IBA) i.e., 0, 2000, 4000, 6000 and 8000 ppm and two dates of collecting cuttings (December, 2000 and April, 2001) on rooting percentage and average number of roots for two local olive cultivars (Nabali and Improved Nabali). It was obvious that the rooting ability of olive is influenced by the interactive effect of cultivar, time of taking cuttings and IBA concentration rather than by the single effect of either. A Considerable difference in rooting ability was found between the genotypes studied. 'Improved Nabali' rooted more readily and gave higher rooting percentage and root number. The results indicated that the best time for taking cuttings was December. IBA at 6000 ppm gave the highest rooting percentages for both cultivars.

Key words: Semihardwood cuttings, *Olea europaea,* Indole butyric acid, rooting

INTRODUCTION

The olive (*Olea europaea* L.) is a long-lived, evergreen tree native to the Mediterranean Sea Basin (Tous and Ferguson, 1996). Olive, in respect to the area planted to fruit trees, is the first major fruit crop grown in Jordan due to its adaptability to a wide range of climatic and soil conditions. Olives are found almost all over the Kingdom from the highlands to the Jordan Valley and the desert. The total area planted with olive trees was about 638 thousand ha in 2000 (Agricultural statistics, Department of Statistics). This represents about 73% of the total area planted with fruit trees.

Several cultivars are used in olive cultivation. Most of them are propagated using stem cuttings, since this method is easy and inexpensive. The rooting ability of stem cuttings differs widely among the cultivars. Nabali and Improved Nabali are considered the dominant genotypes in Jordan. Due to the poor rooting of 'Nabali' olive (Epstien and Wiesman, 1987; Qrunfleh *et al*., 1994) propagators are usually neglecting this cultivar from their consideration.

The use of auxin synergists, mainly Indole butyric acid (IBA), has became a vital practice for induction of adventitious roots in nurseries. Various attempts have been made to enhance rooting ability of olive cultivars with wounding (Ayoub, 1995), plant growth inhibitors (Qrunfleh *et al*., 1994; Wiesman and Lavee, 1995), polyamine treatment (Rugini *et al*., 1990) and different methods of IBA application (Al-Husami, 2001).

The present study was carried out to investigate the rooting ability of two local olive cutivars (Nabali and Improved Nabali) in response to IBA concentration and time of taking cuttings either alone or combined together.

MATERIALS AND METHODS

This investigation was carried out in a partially controlled glasshouse located at the University of Mut'ah campus during the period December, 2000_July, 2001, to study the effect of different concentrations of IBA, cultivar and collection dates on rooting of local olives. The 'Nabali' and 'Improved Nabali' were selected for their widespread planting in orchards and nurseries, both private and public.

One-year-old shoots of 'Nabali' and 'Improved Nabali' olives with a length of 25-35 cm were taken at the morning and covered with moist burlap in December, 2000 and April, 2001. Semihardwood stem cuttings of about 15 cm long with four leaves retained at the upper side were prepared from partially matured shoots. In addition to control treatment, four IBA concentrations (2000, 4000, 6000 and 8000 ppm) were prepared by dissolving the hormone powder in ethanol. Few drops of NH_4OH were added to avoid precipitation of the hormone.

The collected cuttings were wounded by making two opposite longitudinal incisions and dipped in 500 ppm solution of Benlate as a protective measure for fungal infection. Then, the bases of cuttings were treated for 10 seconds with the prepared IBA concentrations as well as control treatment. The cuttings were then inserted into raised benches containing perlite as rooting medium. Mist was applied for 5 sec. every ½ h. The air temperature and relative humidity inside the greenhouse were registered by a thermohydrograph and ranged between 20-22°C.

The influence of IBA concentration, collection date and cultivar was recorded in terms of rooting percentage and number of roots. The experimental design was complete randomized design (CRD). Each treatment was

replicated four times and each replicate was represented by ten cuttings. The data were subjected to analysis according to Snedecor and Cochran (1980). The analysis of variance (ANOVA) was use to determine significant differences. Means were compared by using Least Significant Difference (LSD) test at 5% level.

RESULTS

The rooting percentage and average number of roots per cutting as affected by cultivar, collection season and IBA concentration as well as the interaction among the different variables are presented in Table 1. 'Improved Nabali' cuttings have higher % rooting and more number of roots than 'Nabali'. In addition, %rooting and number of roots were significantly influenced by increasing IBA concentration. However, these traits were not significantly influenced by collection season.

The statistical analysis of the obtained data reveals that the response to interactions between cultivar and season or between cultivar and IBA concentration or between season and IBA concentration was significant (Table 1).

Influence of IBA concentration on rooting percentage: It is clear from Table 2 that rooting percentage of both olive cultivars responds differently to IBA concentration. Cuttings collected in December 2000 gave higher percentage of rooting and greater number of roots than those collected in March, 2001, although the differences were insignificant (Table 1). As concentration of IBA was increased, percent rooting increased. In the first collection season (December, 2000), the rooting percentages of both cultivars were significantly increased by treating the cuttings with 4000 ppm IBA (20.2% for 'Nabali' and 35.0% for 'Improved Nabali'). However, in April 2001 season, the non treated cuttings of ' Nabali' failed to produce any roots. 2000 and 4000 ppm concentrations did not bring significant improvement in rooting percentages of the two cultivars. The rooting percentage was significantly increased by using only 6000 ppm for ' Nabali' (25.3%) and 6000 and 8000 ppm for 'Improved Nabali' (35.2 and 34.8%, respectively) cuttings.

Number of roots: The data showed clearly that increasing IBA concentration from 0 to 8000 ppm increased average number of roots per cutting for the two cultivars in the two seasons (Table 3). In both seasons of collection, the control treatment gave the least root number.

Concerning "Nabali', The highest number of roots per cutting was obtained from the treatment 8000 ppm IBA (2.1 roots /cutting) collected in Dec., 2000 and from the treatment 6000 ppm IBA (2.0 roots/cutting) collected in April, 2001. On the contrary, for 'Improved Nabali', the highest numbers of roots were obtained from the treatments 4000 and 8000 ppm IBA, when collected in Dec. and April, respectively.

Table 1: ANOVA for 'Nabali' and ' Improved Nabali' olive cuttings collected in December, 2000 and April 2001 and treated with five IBA concentrations

		Mean square	
S.O.V	d.f.	Rooting %	Average no. of roots /cutting
Cultivar (cv)	1	3001.3*	58.14*
Season	1	281.3	2.24
IBA conc.	4	1523.1*	8.51*
Cultivar X season	1	31.3*	0.07*
Cultivar X conc.	4	66.9*	0.65*
Season X conc.	4	21.89*	0.23*
Cultivar X season X conc.	4	78.1*	0.67*

*: Significant at 5%.

Table 2: Rooting percentage of 'Nabali' and 'Improved Nabali' olive cuttings as influenced by collection season and IBA concentration

	Nabali		Improved Nabali	
IBA conc. (ppm)	Dec, 2000	April, 2001	Dec, 2000	April, 2001
Control	2.6c	0.0b	15.2b	10.2b
2000	5.1bc	2.7b	22.4ab	22.3ab
4000	20.2ab	15.0ab	35.0a	25.0ab
6000	27.5a	25. 3a	35.2a	32.5a
8000	27.5a	15.0ab	30.0ab	34.8a

Table 3: Average number of roots of 'Nabali' and 'Improved Nabali' olive cuttings as influenced by collection season and IBA concentration

	Nabali		Improved Nabali	
IBA conc. (ppm)	Dec, 2000	April, 2001	Dec, 2000	April, 2001
Control	0.3b	0.0c	2.1b	1.9b
2000	0.8ab	0.3bc	3.0ab	2.6ab
4000	2.0a	1.9a	4.1a	2.9ab
6000	1.9a	2.0a	3.7a	3.1ab
8000	2.1a	1.5ab	2.9ab	3.4a

Means in each column followed by the same letter are not significantly different at P=0.05

DISCUSSION

Generally (*Olea europaea* L.) is propagated commercially by cuttings. There is a wide variation in rooting ability of cuttings among the different cultivars (Avidan and Lavee, 1978; Canozer and Ozahci, 1994; Fouad *et al*., 1990; Loreti and Hartmann, 1964; Pandey and Sinha, 1989; Salama *et al*., 1987). Therefore, the selection of a genotype with high rooting ability is of a prime importance. In this concern, cuttings taken either in December or in April from 'Improved Nabali' gave higher rooting capacity than those taken from 'Nabali', that could be considered as difficult-to-root cultivar. The difficulty of rooting in some cultivars was partially attributed to the presence of continuous sheath of sclerenchyma (Ciampi and Gellini, 1958; Fabbri, 1980;

Qrunfleh *et al*., 1994) or to the increase in cortex thickness during rooting (Ayoub, 2001) forming mechanical barrier to emergence of root initials. Epstien and Lavee (1984) observed clear differences among the tested cultivars in the mobilization velocity of the synthetic auxin, IBA, to the natural one (Indole Acetic Acid). The conversion in hard-to-root cuttings was faster than easy- to- root ones.

Season of collecting olive cuttings throughout the year can play an important role in rooting (Ayoub, 2001; Gautam and Chauhan, 1990; Gellini, 1965; Porlingis and Therios, 1976). In the current study, Although there was insignificant effect for the collection date on rooting, the interactive effect of this factor with IBA concentration is very clear. Meantime, an obvious increase in rooting percentage and number of roots per cutting was attained by the cuttings taken in December. The obtained results are confirmed with those listed by earlier investigators on numerous olive genotypes (Ayoub, 1995; Fouad *et al*., 1990; Hartmann, 1946; Rio *et al*., 1991). According to Porlingis and Therios (1976), the rooting response of adult cuttings to auxin was less than that of juvenile cuttings. The seasonal variation in rooting of softwood olive cuttings was associated with the mobility of high amounts of endogenous auxins (Wiesman and Epstein, 1987) or with the concomitant changes in storage and soluble carbohydrates in the base of cuttings before the rooting period (Rio *et al*., 1991). However, the exogenous application of sucrose to cuttings had no effect on their rooting (Abdel-Hussein and Salman, 1988).

Concentration of IBA had a prominent influence on rooting percentage and root number of the two cultivars since none of the untreated cuttings produced considerable adventitious roots. Increasing IBA concentration from 0 to 8000ppm generally promoted rooting ability of the tested cultivars. The highest percentages of rooted cuttings of the two cultivars in both collection seasons were obtained by treating the cuttings in 4000 – 8000ppm IBA. The positive relationship observed here between rooting and IBA dose was reported by many investigators (Ayoub, 1995; Gautam and Chauhan, 1990; Hartmann, 1946; Loreti and Hartmann, 1964). The effectiveness of auxin to raise rooting percentage of the cuttings could be through increasing cambial activity and differentiation of root primordia (Davies and Joiner, 1980) or by stimulating redistribution and mobilization of some auxin cofactors towards base of the cuttings.

It can be concluded from this study that the rooting ability of olive is affected by the interaction among cultivar, collection season and IBA concentration rather than by the single effect of either. Furthermore, olive could be propagated vegetatively by semihardwood stem cuttings. The best rooting percentages were obtained when the 'Nabali' and 'Improved Nabali' cuttings were treated with 6000 ppm IBA and collected in December.

REFERENCES

Abdel-Hussein, M.A. and M.A. Salman, 1988. Effect of some treatments on the rooting of cv. Nebali olive cuttings. Mesopotamia J. Agric., 20: 59-72.

Al-Husami, H.F., 2001. Studies on rooting of semihardwood 'Nabali' olive cuttings using water soluble indole butyric acid (IBA). M.Sc. Thesis, University of Jordan, Jordan.

Avidan, B. and S. Lavee, 1978. Physiological aspects of the rooting ability of olive cultivars. Acta Hort., 79: 93-101.

Ayoub, S.J., 1995. Improving rooting of semi-hardwood 'Nabali' olive cuttings. M.Sc. Thesis, University of Jordan, Jordan.

Ayoub, S.J., 2001. Physiological and anatomical aspects of rooting 'Nabali' and 'Raseei' olive semi-hardwood stem cuttings. Ph.D. Thesis, University of Jordan, Jordan.

Canozer, O. and E. Ozahci, 1994. Rooting ability of leafy stem cuttings of Turkish olive cultivars. Olivae, 51: 28-33.

Ciampi, C. and R. Gellini, 1958. Anatomical Study on the relationship between structure and rooting capacity in olive cuttings. Nuovo Giorn. Bot. Ital., 65: 417-424.

Davies, F.T. Jr. and J.N. Joiner, 1980. Growth regulator effect on adventitious root formation in leaf bud cuttings of juvenile and mature *Ficus pumila*. J. Amer. Soc. Hort. Sci., 105: 91-95.

Epstien, E. and S. Lavee, 1984. Conversion of Indole-3-butyric acid to indole-3-acetic acid by cuttings of grapevine (*Vitis vinifera*) and olive (*Olea europaea*). Plant and cell Physiol., 25: 697-703.

Epstien, E. and Z. Wiesman, 1987. Improved vegetative propagation of olive cultivars with IBA-alanine. Olea, 18: 35-38.

Fabbri, A., 1980. Influence of some anatomical characteristics on the rooting of 'Frangivento' olive cuttings. Rivista della ortoflorofrutticoltura Italiana, 64: 325-335.

Fouad, M.M., M.A. Fayek and H.H. Selim, 1990. Rooting of eight olive cultivars under mist. Acta Hort., 286: 57-60.

Gautam, D.R. and J.S. Chauhan, 1990. Standardization of IBA concentration and season on rooting of olive cuttings under intermittent mist. Indian J. Hort., 47: 278-285.

Gellini, R., 1965. Seasonal variation in the rooting of olive cuttings. Hort. Abst., 35:7387.

Hartmann, H.T., 1946. The use of root-promoting substances in the propagation of olives by softwood cuttings. J. Amer. Soc. Hort. Sci., 48: 303-308.

Loreti, F. and H.T. Hartmann, 1964. Propagation of olive trees by rooting leafy cuttings under mist. J Amer. Soc. Hort. Sci., 85: 257-264.

Pandey, D. and M.M. Sinha, 1989. A note on the propagation of olive through cutting. Progressive Hort., 21: 182-183.

Porlingis, I.C. and I. Therios, 1976. Rooting response of juvenile and adult leafy olive cuttings to various factors. J. Hort. Sci., 52: 31-39.

Qrunfleh, M.M., Y. Rushdi, T. Musmar and L. Rushdi, 1994. Root formation of the 'Nabali' olives with Uniconazole and Indolebutyric Acid. Dirasat, 21B: 71-79.

Rio, C.D., L. Rallo and J.M. Caballero, 1991. Effects of carbohydrate content on the seasonal rooting of vegetative and reproductive cuttings of olive. J. Hort. Sci., 66: 301-309.

Rugini, E., V. Politi, C. Bignami, M. Agazio, S. Grego and M. De-Agazio, 1990. Effect of polyamine treatments on rooting cuttings of three olive cultivars. Acta Hort., 286: 97-100.

Salama, M.A., M.A. Zahran and M.M. Hassan, 1987. Comparing the rooting ability of some olive cultivars propagated by leafy cuttings under mist. Annals Agric. Sci., Fac. Agric. Ain Shams Univ., 32: 577-590.

Snedecor, C.W. and W.G. Cochran, 1980. Statistical Methods. 7th Ed. Ames, Iowa State Univ. Press., USA.

Tous, J. and L. Ferguson, 1996. Mediterranean Fruits. In: Progress in New Crops, Janick, J. (Ed.). ASHS Press, Arlington, VA., pp: 416-430.

Wiesman, Z. and E. Epstein, 1987. Metabolism and transport of 5-H-Indole-3-butyric acid in cuttings of olive. Olea, 18: 29-33.

Wiesman, Z. and S. Lavee, 1995. Enhancement of IBA stimulatory effect on rooting of olive cultivar stem cuttings. Scientia Hort., 62: 189-198.