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Effect of Preconditioning Treatments and Auxins on the Rooting of Semi-Hardwood Cuttings of Olive Planted During Winter Under Mist Condition

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ABSTRACT

An experiment was conducted during winter to find the effect of girdling, etiolation and auxins i.e. IBA and NAA on rooting of semi- hardwood cuttings of olive cv. Leccino under mist. The experiment comprised of 13 treatments and was combinations of girdling, etiolation and auxins. The results indicated that the best rooting characteristics viz; highest percent rooted cuttings (53.33), number of primary roots (6.58) and secondary roots (8.53) and diameter (0.46 mm) were maximum with cuttings treated with IBA at 5000 ppm, where as the maximum primary root length (5.30 cm) and secondary root length (2.42) was recorded with the treatment girdling + IBA 4000 ppm + NAA 1000 ppm and IBA 4000 ppm, respectively. Regarding the shoot characteristics viz; plant height (14.59 cm) was recorded highest for the treatment IBA@ 4000 ppm which was at par with the treatment IBA @ 5000 ppm (14.26 cm). Highest plant diameter (2.40 mm), numbers of leaves (16.26) and leaf area (36.42 cm^2) were highest for the treatment IBA @ 5000 ppm. Survival percentage of cuttings (71.57 %) was also highest in cuttings treated with IBA @ 5000 ppm. It is concluded that IBA at 5000 ppm was found to be the best treatment for propagation of olive through semi- hardwood cuttings during winter.

Keywords: Olive, Auxin, IBA, NAA, Etiolation, Girdling, Rooting, Cutting.

INTRODUCTION

The olive (*Olea europaea* L.) is the most important subtropical fruit grown in the Mediterranean region of the world. Known as a highly beneficial fruit, olive oil eliminates excess cholesterol in the blood, controls blood pressure. It is a great source of vitamin E and reduces the effect of degenerative diseases like Alzheimer, benign and malignant tumors. Protects body against anemia, improves fertility and reproductive system. It contains oleic acid which is excellent for heart health. Contain polyphenols that reduce oxidative stress in the brain. It stimulates the production of adiponectin, a chemical that burns fat. Olives as such are rich in minerals such as sodium, potassium, magnesium, iron, phosphorus and iodine.

Olive plantation can be successfully done in lower regions of Jammu and Kashmir, Himachal and parts of Uttarakhand. Olive is generally propagated by cuttings as the seedling rootstocks are not fully compatible with all the olive cultivars; hence propagation by rooting of leafy cuttings under mist is recommended for certain varieties and grafting for others[1].

The most widely used methods of propagation in olive are rooting of its hardwood, semi-hardwood and softwood leafy cuttings. But olive cultivars show wide variation in their rooting potentials[2]. Various studies have revealed that preconditioning treatments like etiolation, girdling, periderm stripping coupled with growth regulators have to a great extent influenced the rooting ability

of olive cuttings. So these treatments prior to growing cuttings under mist have been found to enhance their rooting potential[3,4]. Girdling of shoots prior to their detachment from the mother tree stimulates the process of rhizogenesis in the cuttings and ultimately enhanced the extent of rooting in olive cultivars[5]. Etiolation of shoots prior to their detachment from mother tree has also tended to improve rooting potentials to a wide range of difficult-to-root plant species[6]. They also reported an increase in the number of roots emerged from the cuttings in olive when shoot of stock plant were etiolated.

The use of exogenous plant growth regulators for enhancing the success rate of cuttings is one of the most commonly used method[7]. Application of plant growth regulators, especially auxins increases the percentage of cuttings that form roots, hastens root initiation, and increases the uniformity of rooting. Indole-3-butyric acid (IBA) is the best auxin for this purpose because it is non-toxic to plants over a wide range of concentrations and is effective in promoting rooting of a large number of plant species[8].

The propagation of olive cuttings under mist has become a usual practice throughout the world. Some olive cultivars are easily rooted, while others are difficult-to-root. This variation among cultivars may be attributed to the differences in the rooting potentialities. Propagation by cuttings of these cultivars has also presented problems because of low rooting ability. Hence, the present study was undertaken to determine the effect of girdling, etiolation and auxins on the rooting of this difficult to root olive cultivar Leccino.

MATERIALS AND METHODS

The cuttings were planted in winter (i.e. in February), 2010-11 at Dr. Y. S. Parmar university of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The experiment was laid out in Randomized Block Design with three replications with 20 cuttings in each replication. There were 13 treatments, viz., T_1- IBA 4000 ppm; T_2- IBA 5000 ppm; T_3- NAA 1000 ppm; T_4- NAA 1500 ppm; T_5- Girdling + IBA 4000 ppm + NAA 1000 ppm; T_6-Etiolation +IBA 4000 ppm+ NAA 1000 ppm; T_7- Girdling + IBA 4000 ppm + NAA 1500 ppm; T_8-Etiolation +IBA 4000 ppm+ NAA 1500 ppm; T_9- Girdling + IBA 5000 ppm + NAA 1000 ppm; T_{10}-Etiolation +IBA 5000 ppm+ NAA 1000 ppm; T_{11}- Girdling + IBA 5000 ppm + NAA 1500 ppm; T_{12}- Etiolation +IBA 5000 ppm+ NAA 1500 ppm; T_{13}- IBA 5000 ppm + NAA 1500.

Rooting medium was prepared by mixing garden soil, sand and FYM in (1:1:1). The basal portion of the three node cuttings was dipped in the growth regulator solution for 8- 10 seconds and then planted in the rooting medium in beds with the basal node inside the rooting media. At the end of the experiment, five cuttings from each replication were randomly lifted from the bed and observations on the root and shoot characters were recorded. The data collected on various parameters were subjected to statistical analysis as described [9]. The treatment effects were tested at 5 per cent level of significance.

RESULTS AND DISCUSSION

The highest rooting (53.33 per cent) was recorded in the cuttings treated with IBA 5000 ppm which was significantly higher to all other treatments (Table 1.). Maximum numbers of primary roots (6.58) were recorded in cuttings treated with IBA 5000 ppm (Table 1.). This treatment was statistically at par with treatment Girdling + IBA 4000 ppm + NAA 1000 ppm (6.10). Hence girdling along with auxins increased number of primary roots in semi-hardwood cuttings of olive. The maximum diameter of primary roots (0.46 mm) and highest numbers of secondary roots (8.53) were recorded in cuttings treated with IBA 5000 ppm (Table 1 & 2).

Maximum length of primary roots was recorded in cuttings treated with Girdling + IBA 4000 ppm + NAA 1000 pm (5.38 cm) and IBA 4000 ppm (5.08 cm) (Table 1) and maximum length of secondary roots (2.42 cm) was noticed in cuttings treated with IBA 4000 ppm (Table 2). This treatment was statistically at par with treatments Girdling + IBA 4000 ppm + NAA 1000 ppm (2.30 cm) and IBA 5000 ppm (2.15 cm). Thus girdling was observed to increase root length along with auxins. Highest fresh weight of roots (0.62 g) was recorded in cuttings treated with Girdling + IBA 4000 ppm + NAA 1000 ppm and highest dry weight of roots (0.24 g) was recorded in cuttings treated with Girdling + IBA

4000 ppm + NAA 1000 ppm which was statistically at par with treatment IBA 5000 ppm (0.21 g) (Table 2). Thus, girdling along with auxins enhanced fresh weight of roots. This can be explained on the basis that Girdling + IBA 4000 ppm + NAA 1000 ppm and IBA at 5000 ppm produced better results in terms of root number, diameter and fairly better results in terms of root length which produced highest fresh as well as dry weight.

Among shoot characteristics, maximum plant height (14.59 cm) was recorded in cuttings treated with IBA 4000 ppm. This treatment was statistically at par with treatments, IBA @ 5000 ppm (14.26 cm) and Girdling + IBA 4000 ppm + NAA 1000 ppm (14.02 cm). It is clear from the data presented in table 3 that identical values related to plant height were observed irrespective of the treatments. Maximum plant diameter (2.40 mm) was recorded in cuttings treated with IBA 5000 ppm (Table 3). This treatment was statistically at par with treatments, Girdling + IBA 4000 ppm + NAA 1500 ppm and Girdling + IBA 4000 ppm + NAA 1000 ppm exhibiting 2.30 mm and 2.25 mm plant diameter, respectively. Das *et al.* (2006) also reported highest shoot characteristics in terms of shoot length and girth in olive cv. Maximum number of leaves (16.26), leaf area (36.42 cm^2) and the highest field survival (71.57 per cent) were recorded in cuttings treated with IBA 5000 ppm and this treatment was significantly superior to all other treatments (Table 3).

Table 1: Effect of preconditioning treatments and auxins on per cent rooting, root number, root length and diameter of primary roots in semi-hardwood cuttings of olive

Treatment	Concentration (ppm)	Rooting (%)	Average number of primary roots	Average root length (cm)	Average root diameter (mm)
T1	IBA-4000	45.00 (42.09)	5.67	5.08	0.41
T2	IBA-5000	53.33 (46.92)	6.58	4.72	0.46
T3	NAA-1000	11.66 (19.89)	2.54	2.97	0.29
T4	NAA-1500	13.33 (21.34)	2.13	3.56	0.32
T5	Girdling+ IBA (4000) +NAA (1000)	46.66 (43.09)	6.10	5.38	0.40
T6	Etiolation+IBA (4000)	41.66 (40.20)	4.05	4.66	0.40
T7	Girdling+IBA (4000) +NAA (1500)	40.00 (39.21)	3.28	4.15	0.37
T8	Etiolation+IBA (4000) +NAA (1500)	35.00 (36.24)	3.18	4.56	0.34
T9	Girdling +IBA (5000) +NAA (1000)	33.33 (35.22)	5.10	4.05	0.38
T10	Etiolation+IBA (5000) +NAA (1000)	28.33 (32.02)	4.56	3.96	0.30
T11	Girdling+IBA (5000) +NAA (1500)	26.66 (30.95)	4.11	3.21	0.33
T12	Etiolation+IBA (5000) +NAA (1500)	16.66 (24.05)	4.31	3.00	0.30
T13	IBA(5000)+ NAA(1500)	20.00 (26.45)	3.38	3.33	0.31
MEAN	31.66	4.23	4.04	0.35	
CD0.05	5.43	0.49	0.40	0.04	

Figures in the parentheses are arc sine transformed values

DISCUSSION

The results regarding rooting characteristics are in agreement with[10], who also recorded highest rooting percentage (80 %), number and diameter of primary and secondary roots when semi- hardwood cuttings of olive cv. Leccino were planted under zero energy poly- trenchand treated with IBA at 5000 ppm. The highest rooting and rooting characteristics in olive cultivar Ascolano were observed when cuttings were treated with 5000 ppm IBA[11]. The semi-hardwood cuttings of olive cultivar Leecino, Memeli and Coratina rooted best and gave best rooting characters when treated with 5000 ppm IBA[12]. The highest rooting in cuttings of olive cv. Gemlik (easy to root) was obtained when dipped in the solution of 5000-6000 ppm IBA for 5 seconds[13]. Propagation of olive cv. Leccino through stem cuttings and wild olive through stem hard wood cuttings, respectively resulted in the longest primary and secondary root length under lower concentration of IBA and vice-versa[10,11]. The effect of preconditioning treatments and auxin on rooting of cuttings of kiwi cv. Allison was observed and found that blanching and girdling along with auxin (IBA @ 5000 ppm) to produce longest roots[14]. IBA was also applied at lower concentration (lesser than 5000 ppm) to produce highest root length in clonal rootstock of apple i.e. MM106, MM111, M2, M9 and MM 106, respectively[15,16].

The increase in shoot length is related to better rooting performance which facilitated the enhanced nutrient uptake and ultimately increased the shoot length[17]. The highest field survival in olive cuttings having higher values for root and shoot characters[18,19,10]. This might be due to better development of root system and shoot system when cv. Leccino this was treated with IBA at 5000 ppm. The highest mean shoot length and girth was observed, when cuttings of pomegranate cv. Ganesh were treated with IBA 5000 ppm[20]. When effect of IBA on rooting of hardwood cuttings of kiwi was studied, it was found that IBA at concentration of 5000- 6000ppm superior for all root and shoot traits[21]. Thus, these events might have facilitated the rooted cuttings to make better growth (i.e. more number of leaves and leaf area) under field conditions after plantation and thereby accounting highest field survival percentage.

Table 2: Effect of preconditioning treatments and auxins on the number and length of secondary roots and fresh and dry weight of roots in semi-hardwood cuttings of olive

Treatment	Concentration (ppm)	Average number of secondary roots	Average secondary root length (cm)	Fresh weight of root (g)	Dry weight of roots (g)
T1	IBA-4000	7.00	2.42	0.53	0.17
T2	IBA-5000	8.53	2.15	0.55	0.21
T3	NAA-1000	4.11	2.10	0.40	0.12
T4	NAA-1500	3.88	2.00	0.36	0.11
T5	Girdling+ IBA (4000)+NAA (1000)	7.86	2.30	0.62	0.24
T6	Etiolation+IBA (4000)+NAA (1000)	5.06	2.00	0.50	0.16
T7	Girdling+IBA (4000)+NAA (1500)	4.90	2.09	0.50	0.17
T8	Etiolation+IBA (4000)+NAA (1500)	4.52	1.96	0.52	0.17
T9	Girdling +IBA (5000)+NAA (1000)	6.63	2.07	0.48	0.16
T10	Etiolation+IBA (5000)+NAA (1000)	5.74	1.91	0.45	0.15
T11	Girdling +IBA (5000)+NAA (1500)	5.14	1.80	0.46	0.16
T12	Etiolation+IBA (5000)+NAA (1500)	5.37	1.62	0.44	0.14
T13	IBA (5000)+ NAA (1500)	4.37	1.89	0.43	0.13
	MEAN	5.62	2.02	0.48	0.16
	CD0.05	0.58	0.30	0.04	0.04

Table 3: Effect of preconditioning treatments and auxins on plant height, plant diameter, number of leaves, leaf area and field survival in semi-hardwood cuttings of olive

Treatment	Concentration (ppm)	Plant height (cm)	Average plant diameter (mm)	Number of leaves	Total leaf area (cm2)	Field survival (%)
T_1 (53.81)	IBA-4000	14.59	2.12	14.29	34.67	65.12
T_2 (57.79)	IBA-5000	14.26	2.40	16.26	36.42	71.57
T_3 (39.57)	NAA-1000	8.55	1.45	9.95	16.65	40.58
T4 (41.12)	NAA-1500	7.86	1.49	9.80	16.38	43.25
T_5 (55.15)	Girdling+IBA(4000) +NAA(1000)	14.02	2.25	14.73	32.17	67.33
T_6 (51.62)	Etiolation+IBA(4000) +NAA(1000)	13.13	2.05	13.36	13.36	61.44
T_7 (52.96)	Girdling+IBA(4000) +NAA(1500)	13.51	2.30	13.67	30.16	63.70
T_8 (51.51)	Etiolation+IBA(4000) +NAA(1500)	13.33	1.86	13.13	13.13	61.25
T_9 (49.47)	Girdling+IBA(5000) +NAA(1000)	12.83	1.95	12.35	24.67	57.76
T_{10} (46.12)	Etiolation+IBA(5000) +NAA(1000)	12.32	1.72	12.43	24.72	51.94
T_{11} (45.05)	Girdling+IBA(5000) +NAA(1500)	11.94	1.78	11.89	20.16	50.07
T_{12} (42.69)	Etiolation+IBA(5000) +NAA(1500)	11.57	1.61	11.37	18.50	45.97
T_{13} (44.09)	IBA(5000)+ NAA(1500)	10.23	1.54	10.76	17.63	48.40
	MEAN	12.16	1.88	12.61	25.57	56.02
	CD0.05	0.73	0.24	0.94	1.21	1.72

Figures in the parentheses are arc sine transformed values

CONCLUSION

The results obtained in the present study showed IBA at 5000 ppm to obtain best results in terms of rooting per cent (53.33), root characters like highest number of primary roots (6.58), root diameter (0.46 mm) and number of secondary roots (8.53), shoot characters such as highest plant height

(14.26 cm), plant diameter (2.40 mm), number of leaves (16.26), leaf area (36.42 cm^2) and survival percentage of 71.57 per cent semi hard wood cuttings of olive when planted during February under mist was recorded for IBA @ 5000 ppm. Girdling along with auxins although was not found to be significant for rooting percentage and field survival but was reported to have positive impact on various root and shoot characters such as number and length and as well as fresh and dry weight of roots.

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