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IBA Promotes Rooting in the Hardwood Cuttings of Olive (*Olea europaea* L.) Cultivars

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Abstract: The study was carried out to propagate olive (*Olea europaea L.*) cultivars from hardwood cuttings with IBA (Indole butyric acid) at 2000, 4000 and 6000 ppm. IBA at 4000 ppm significantly promoted maximum sprouting (90%), highest survival (76.70%) and produced lengthy shoot (5.8 cm) for cultivar Domate and maximum number of roots 6.9 per cutting in the cultivar at 2000 ppm IBA. Root length in the cultivar was increased at 2000 ppm of IBA. The cultivar N.D. Belice was the 2nd best to give good response to various levels of growth regulator. The cuttings of the remaining cultivars showed little response to IBA.

Key words: Olive; *Olea europaea L.*; propagation; growth regulator; IBA; hardwood cuttings; survival percentage, shoot length; number and root length, Pakistan.

Introduction

Olive (*Olea europaea* L.) belongs to the family Oleaceae. Wild olive grooves are common in sub-mountainous area of the North-West Frontier Province and adjoining tribal areas. This specie has no commercial value except as fodder. The economic importance of European olive has been highlighted by Khattak *et al.* (1997). The specie has large fruit, rich in oil. Olive oil is edible and has medicinal value.

There is an acute shortage of edible oil in Pakistan while billions of rupees are spent on import of vegetable oil. In order to meet the requirements of edible oil, the commercial plantation of European olive in the country can contribute 25-35% to the total national production of cooking oil. European olive plantation on large scale is not existing in the country may be due to non-availability of desirable cultivars.

Propagation of olive through seed is not a desirable method due to segregation and also their seedlings require longer time to come into bearing. European olive is usually top worked onto wild olive in Pakistan but such technique resulted in very low percentage of graft success and had proven unsuitable for present commercial requirements (Giani, 1968). True to type that clonal plants can be produced through cuttings, treated with IBA (Hartmann *et al.*, 1993). In this connection Khattak *et al.* (1981) obtained 22.5% rooting in the semi-hardwood cuttings of olive cultivar Leccino when treated with IBA at 6000 ppm. The number and length of roots per cutting was increased with 9000 ppm of the hormone. Likewise, Khattak *et al.* (1987) used slow immersion method to propagate olive cultivar Leccino. They treated semi-hardwood cuttings in 100, 250 and 500 ppm of IAA and NAA in aqueous solution. It was found that IAA at the rate of 500 ppm for six hours immersion resulted into better rooting. Maximum roots per cutting were produced with application of 500 ppm IAA for 12 hours and the root length was also increased with IAA at 500 ppm for 24 hours duration. Abdel and Salman (1988) treated stem cutting of olive with IBA. They obtained better rooting at 4000 ppm of IBA. Olive cuttings (hardwood) treated with IBA at 3000 ppm produced maximum rooting in olive cultivar Leccino when dipped for 5 minutes under plastic tunnel. Low concentration (1500 ppm) of IBA increased the root length while number of roots per cutting was significantly higher at 6000 ppm of the chemical (Khattak *et al.*, 1999).

Materials and Methods

The study was carried out at the experimental area of the Directorate of Horticulture FATA, Agricultural Research Institute, Tarnab, Peshawar. Cuttings of five cultivars of olive for instance, Nocellara Del Belice (N.D Belice), Biancolilla, Pendolino, Coratina and Domate, 25-30 cm long with three leaves each and pencil size diameter were taken from six years old trees, growing at the Horticulture Research Nursery Farm, Miran Shah. The cuttings were taken on February 23, 2000. The basal end of the cuttings (5-6 cm) was immersed in Indole butyric acid (IBA) at 2000, 4000 and 6000 ppm for 5 minutes. After treatment the cuttings were planted in soil medium sand + silt + clay (1:1:1) in plastic tunnel in raised beds 30 cm apart. After planting the experimental area was irrigated. The experiment was laid out in Randomized Complete Block Design (RCB) with four replications. There were 10 cuttings per treatment. The data regarding sprouting, survival, shoot length, number of roots per cutting and root length were analyzed statistically and the means of the parameters were separated according to Least Significant Difference (LSD) test.

Results and Discussion

Table 1 shows that cultivar Domate significantly exhibited maximum percentage of sprouting (90%) at 4000 ppm of IBA, followed by the same cultivar (73.33%) at 6000 ppm of IBA. The response of other cultivars at different levels of IBA were not so much pronounced. Control gave less sprouting. While comparing the mean values of the cultivars, Domate superseded other cultivars. Among the treatments IBA at 4000 ppm significantly enhanced the sprouting percentage.

Survival data on olive cutting were depicted below in Table 2. Survival data followed the same trend as reported for sprouting of olive cutting. IBA at 4000 ppm resulted maximum survival of 76.7% in the cuttings in cultivar Domate. The second best treatment was IBA at 6000 ppm where 70% survival was noted in the above cultivars. Non-treated cuttings had less survival in this case. While comparing the mean values of the cultivars, Domate was found the best among the cultivars. Among the hormonal treatment IBA at 4000 ppm was the best treatment that gave maximum survival percentage in the experiment.

Data regarding shoot length (cm) is arranged in Table 3. Shoot length was significantly prolonged (5.8 cm) in the cultivar Domate at 4000 ppm of IBA. This was followed by IBA at 2000 ppm of IBA in the above cultivar (4.8 cm). Shoot length in other treatments failed to manifest their response.

Table1: Sprouting percentage in different cultivars of olive (*Olea europaea* L.) as affected by various levels of IBA.

Name of cultivars	IBA (ppm)				Means
	0	2000	4000	6000	
N.D. Belice	13.33 k	50.00 de	60.00 c	46.00 ef	42.50 b
Biancolilla	13.33 k	26.66 l	33.33 h	26.66 i	25.00 cd
Pendolino	10.00 k	20.00 j	26.66 l	20.00 j	19.17 d
Coratina	23.33 ij	23.33 ij	43.33 g	40.00 g	32.50 l
Domate	20.00 j	53.33 d	90.00 a	73.33 b	59.17 a
Means	16.00 c	34.67 b	50.67 a	41.33 b	

Means followed by different letters are significant different at 1% level of probability.

Table2: Survival percentage in different cultivars of olive (*Olea europaea* L.) as affected by various levels of IBA.

Name of cultivars	IBA (ppm)				Means
	0	2000	4000	6000	
N.D. Belice	10.00i	40.00d	46.66c	43.33cd	35.00b
Biancolilla	10.00i	20.00fg	23.33f	16.66gh	17.50c
Pendolino	10.00i	16.66gh	20.00fg	13.33hi	15.00c
Coratina	13.33hi	16.66gh	33.33e	20.00fg	20.83c
Domate	20.00fg	43.33cd	76.66a	70.00b	53.50a
Means	12.67c	27.33b	46.00a	32.67b	

Means followed by different letters are significantly different at 1% level of probability.

Table3: Shoot length in different cultivars of olive (*Olea europaea* L.) as affected by various levels of IBA.

Name of cultivars	IBA (ppm)				Means
	0	2000	4000	6000	
N.D. Belice	1.4	1.7	1.7	1.8	1.71
Biancolilla	1.7	2.0	2.0	2.0	1.95
Pendolino	1.7	2.1	2.5	2.8	2.29
Coratina	1.8	3.0	3.1	3.4	2.83
Domate	2.0	4.8	5.8	4.0	4.12
Means	1.7	2.73	3.0	2.84	

Means followed by different letters are significantly different at 1% level of probability.

Table4: No. of roots per cutting in different cultivars of olive (*Olea europaea* L) as affected by various levels of Indole butyric acid.

Name of cultivars	IBA (ppm)				Means
	0	2000	4000	6000	
N.D. Belice	1.3	5.0	3.9	2.7	3.20
Biancolilla	1.2	3.0	2.8	2.8	2.50
Pendolino	1.6	3.1	2.7	2.5	2.50
Coratina	1.5	3.4	2.8	2.4	2.50
Domate	1.4	6.9	5.5	4.3	4.60
Means	1.4	4.3	3.5	4.3	

Table5: Root length (cm) in different cultivars of olive (*Olea europaea* L) as affected by various levels of Indole butyric acid.

Name of cultivars	IBA (ppm)		Means		
	0	2000	4000	6000	
N.D. Belice	2.5	2.0	3.2	1.7	2.3
Biancolilla	2.1	2.8	3.7	2.2	2.6
Pendolino	1.5	2.3	3.8	3.1	2.7
Coratina	1.9	2.8	4.4	2.9	3.0
Domate	2.0	3.4	4.9	3.4	3.4
Means	2.00	2.66	3.9	2.7	

Mean values among cultivars showed that Domate has given better response than the other cultivars. The treatments 2000 and 4000 ppm of IBA were the best and statistically at par and produced 2.73 and 3.0 cm respectively.

Data on number of roots per cutting (Table 4) showed that IBA at 2000 ppm in cultivar Domate had dominated over other treatments with the highest number of roots per cuttings (6.9). IBA at 4000 ppm was the next treatment that resulted 5.5 roots per cutting. Very few roots were initiated in non-treated cuttings of cultivars. Mean values of cultivars (Table 4) depicted that cultivar Domate was found to be the best than other cultivars as regards the number of roots per cuttings. As far as the treatment means are concerned, IBA at 2000 ppm and 6000 ppm produced more number of roots per cutting (4.3), followed by IBA at 4000 ppm. The interaction between varieties and treatment was non-significant (Table 5). Comparing the mean values it was observed that cultivar Domate at 4000 ppm IBA produced longer roots (4.9 cm). Among the treatments IBA at 4000 ppm was found better than the other treatments.

It can be concluded that IBA at 4000 ppm significantly promoted sprouting, survival, shoot and root lengths in hardwood cuttings of olive cultivar Domate, the number of root were pronounced at 2000 ppm of the chemical in the above cultivar. The next best cultivar was N.D Belice that gave good response to IBA at 4000 ppm only for number of roots per cutting, sprouting and survival percentages. The remaining cultivars failed to manifest their response at different levels of IBA in the trial. It can be concluded from the above deliberation that endogenous hormones interacted with optimum level (4000 ppm) of IBA to initiate root primordia in the cuttings of cultivar Domate. Root length in the cultivar was increased at 2000 ppm of IBA, this confirmed the mode of action of auxin as dual effect of hormone. On one side at lower concentration of auxin it enhanced the number of roots while on the other side higher concentration (4000 ppm) as reported earlier, root length was increased.

The response of other cultivars of olive showed negative result at various levels of IBA. It showed that IBA has antagonistic effect on the endogenous hormones that inhibit the root initial at the basal end of the cuttings and hence fewer rooting were observed, however, further research is needed to include other growth regulators and study their effect on rooting of cuttings of olive cultivars.

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