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Effect of Various Growth Media on Success of Olive Cuttings

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Abstract: Present study was aimed at determining the best combination of growing media to enhance rooting of olive cuttings. Different combinations of growth media, garden soil, sand, Farm yard manure (FYM) and peat moss were studied with three cultivars of olive i.e., Leccino, Coratina and Frontoio, to select the best propagation media for growth of olive cuttings. The results of the study demonstrated that propagation media with combinations of all the selected media, i.e., Garden Soil, Sand, FYM and Peat moss, was the best in terms of survival, rooting and shooting of cuttings. This media has shown the best results in Coratina variety, which shows that growth media influences the survival, shooting, rooting and other growth characteristics of an olive plant.

Key words: Olive, Indole butyric acid, Peat moss, FYM, Coratina, Leccino and Frontoio.

INTRODUCTION

Olive (*Olea europaea* L.), belonging to family Oleaceae, is a relatively slow growing plant, long lived with life reported to be many thousand years (Awan *et al.*, 2001). It is perhaps the most ancient cultivated fruit tree of arid and semi-arid areas of Mediterranean basin (Isfendiyaroglu *et al*., 2009). The native of olive is the Mediterranean region, Africa and Asia (Mohammed and Noori, 2008). Olive has a great importance in human health and nutrition. It contains no carbohydrate or protein. Olives are very good source of many minerals and vitamins for human health. Olive is a rich source of vitamin E and dietary fibers as an alternative source of fruits and vegetables (Tripoli *et al*., 2005). Top producing countries are Italy, France, Turkey and Spain. Now Pakistan is importing olive from Turkey. Due to market demand, it is also an important crop for oil extraction (Muzzalupo *et al*., 2012).

It can be propagated sexually by seeds and asexually by cuttings or air-layerings, sexual propagation is not recommended as the seedlings are not true-to-type and their juvenile period is long, causing delayed fruiting (Alam and Sajid, 2017). Hardwood cutting is the most preferred method of propagation as it is a rapid and simple way, besides maintaining genetic uniformity (Awan *et al.*, 2001). Olive plants raised in nursery through cuttings usually grow uniformly and are dwarf in height with an advantage that these are early, uniform and stable in bearing (Mitra *et al.*, 1982). For olive cuttings propagation, the most commonly practiced method is by mist propagation of leafy cuttings (Isfendiyaroglu *et al.*, 2009).

Rooting of cuttings is affected by certain internal and external factors like, cultivar, time and rooting media (Gerakakis and Ozkaya, 2005). Rooting media is generally considered to be one of the crucial inputs to initiate rooting with supreme quality (Dolor *et al.*, 2009). Rooting media should be selected on the basis of criteria, i.e., availability and cost of rooting media components (Hartmann *et al.*, 2007), quality (pH, particle size, freedom from salts, weeds, silt and seeds), adequate aeration, physical structure and with the ability to be mixed easily and standardized (FAO-TECA, 2011). Peat moss is now a commonly used media, due to its properties of homogeneity and quality added to media, but an expensive media too (Abdel-Mohsen, 2015).

This study was designed with an aim of determining the best possible combination of olive growth media to enhance rooting of olive cuttings, as olive is a very slow growing and hard-to-root crop, so it needs special attention towards the best growth media to promote rooting.

MATERIALS AND METHODS

This experiment was conducted at National Agricultural Research Centre (NARC), Islamabad, during 2017. There are no proper media combinations

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developed so far. For this purpose, hardwood olive cuttings were collected from healthy olive plants of three varieties, i.e., Frontoio, Leccino and Coratina. Cuttings were prepared and dipped in an indole butyric acid (IBA) solution (3500 ppm) and planted on different media combinations:

T_0 = Garden soil

T_1 = Sand

T_2 = Garden soil + Sand + Peat moss

T_3 = FYM + Garden soil

T_4 = FYM + Sand + Garden soil

T_5 = Garden soil + Sand + FYM + Peat moss

Following parameters were observed and data was recorded:

- Sprouting percentage
- Survival percentage
- Number of roots per cutting
- Root length
- Number of shoots per cutting
- Shoot length
- Number of leaves per cutting

Data was analyzed using analysis of variance (ANOVA) Duncan's Multiple Range Test at $P<0.05$.

RESULTS AND DISCUSSION

Table 1 illustrates that T_5 (Garden soil + Sand + FYM + Peat moss) gained maximum sprouting percentage (80%) in V_1 (Coratina), followed by 70% at T_2, T_3, T_4 and T_5 in V_1 (Coratina), respectively. Maximum mean sprouting percentage (70%) was obtained with T_5 (Garden soil + Sand + FYM + Peat moss), followed by 61.66% at T_2 (Garden soil + Sand + Peat moss), while maximum mean sprouting percentage (65%) was gained by V_1 (Coratina), followed by V_2 (Frontoio) with 57% sprouting.

Table 1: Effect of different media on sprouting percentage of different olive varieties.

	V1	V2	V3	Mean
T_0	40 ef	35 f	30 g	35 D
T_1	60 c	50 d	40 ef	50 C
T_2	70 b	65 c	50 d	61.66 B
T_3	70 b	60 c	45 e	58.33 BC
T_4	70 b	62 c	46 e	59.33 BC
T_5	80 a	70 b	60 c	70 A
Mean	65 A	57 B	45.16 C	

Table 2 depicts that T_5 (Garden soil + Sand + FYM + Peat moss) attained maximum survival percentage (40%) in V_1 (Coratina), followed by 38% at T_5 in V_2 (Frontoio), respectively. Maximum mean survival percentage (37.66%) was obtained with T_5 (Garden soil + Sand + FYM + Peat moss), followed by 29.66% at T_4 (FYM + Sand + Garden soil) and maximum mean survival percentage (27.16%) was gained by V_1 (Coratina), followed by V_2 (Frontoio) with 24.66% survival.

Table 2: Effect of different media on survival percentage of different olive varieties.

	V1	V2	V3	Mean
T_0	15 cd	15 cd	12 d	14.00 D
T_1	23 bc	20 bc	18 c	20.33 C
T_2	25 b	24 bc	22 bc	23.66 BC
T_3	25 b	22 bc	20 bc	22.33 BC
T_4	35 ab	29 b	25 b	29.66 B
T_5	40 a	38 ab	35 ab	37.66 A
Mean	27.16 A	24.66 AB	22 B	

Table 3 shows significant differences with number of roots per cutting. T_5 (Garden soil + Sand + FYM + Peat moss) produced maximum number of roots (7.8) in V_1 (Coratina), followed by 6.5 at T_4 (FYM + Sand + Garden soil) in V_2 (Frontoio). Maximum mean number of roots per cutting, i.e., 6.54 were attained with T_5 (Garden soil + Sand + FYM + Peat moss), followed by 5.36 at T_2 (Garden soil + Sand + Peat moss) and maximum mean number of roots were attained by V_1 (Coratina).

Table 3: Effect of different media on number of roots per cutting of different Olive varieties.

	V1	V2	V3	Mean
T_0	3.2 ef	2.98 f	2.71 f	2.96 F
T_1	5.2 d	4.05 de	3.84	4.36 D
T_2	6.9 b	4.98 d	4.21 de	5.36 B
T_3	4.3 de	3.78 e	3.61 e	3.89 E
T_4	6.1 c	4.51 de	4.39 de	5.00 C
T_5	7.8 a	6.5 b	5.33 d	6.54 A
Mean	5.58 A	4.46 B	4.015 C	

Table 4 shows maximum root length (5.1 cm) at T_5 (Garden soil + Sand + FYM + Peat moss) in V_1 (Coratina), followed by 4.7 cm at T_2 (Garden soil + Sand + Peat moss) in V_1 (Coratina). Maximum mean root length, i.e., 4.31 cm, was attained with T_5 (Garden soil + Sand + FYM + Peat moss), followed by 4.28 cm at T_2 (Garden soil + Sand + Peat moss) and maximum mean root length (3.8 cm) was attained by V_1 (Coratina).

Table 4: Effect of different media on root length (cm) of different olive varieties.

	V1	V2	V3	Mean
T_0	2.4 e	2.0 e	2.0 e	2.26 D
T_1	3.5 cd	3.2 cd	3.0 d	3.23 C
T_2	4.7 ab	4.2 b	3.94 c	4.28 AB
T_3	3.0 d	2.8 de	2.69 de	2.83 CD
T_4	4.1 b	4.00 c	3.86 c	3.98 B
T_5	5.1 a	4.5 b	3.33 cd	4.31 A
Mean	3.8 A	3.45 B	3.13 BC	

Table 5 shows maximum number of shoots per cutting (4.7) in T_5 (Garden soil + Sand + FYM + Peat moss) with V_1 (Coratina), followed by 4.1 at T_2 (Garden soil + Sand + Peat moss) in V_1 (Coratina).

Maximum mean number of shoots per cutting, i.e., 3.76, were attained with T_5 (Garden soil + Sand + FYM + Peat moss), followed by 3.3 at T_2 (Garden soil + Sand + Peat moss) and maximum mean number of shoots were attained by V_1 (Coratina), respectively.

Table 5: Effect of different media on number of shoots per cutting of olive varieties.

	V1	V2	V3	Mean
T_0	3.0 c	2.2 d	2.1 d	2.43 CD
T_1	3.4 bc	2.5 cd	2.3 cd	2.73 C
T_2	4.1 b	3.0 c	2.8 cd	3.3 B
T_3	3.1 c	2.3 cd	2.1 d	2.5 CD
T_4	3.8 bc	2.8 cd	2.6 cd	3.06 B
T_5	4.7 a	3.5 bc	3.1 c	3.76 A
Mean	3.68 A	2.71 B	2.5 BC	

Table 6 displays maximum shoot length (36.5 cm) at T_5 (Garden soil + Sand + FYM + Peat moss) in V_1 (Coratina), followed by 32.8 cm at T_2 (Garden soil + Sand + Peat moss) in V_1 (Coratina). Maximum mean shoot length, i.e., 31.73 cm, was gained with T_5 (Garden soil + Sand + FYM + Peat moss), followed by 29.00 cm at T_2 (Garden soil + Sand + Peat moss) and maximum mean shoot length (36.5 cm) was attained by V_1 (Coratina).

Table 6: Effect of different media on shoot length of olive varieties.

	V1	V2	V3	Mean
T_0	28.6 bc	23.0 cd	20 d	23.86 C
T_1	30.1 bc	25.1 cd	23.9 cd	26.36 BC
T_2	32.8 b	28.5 bc	25.7 cd	29.00 B
T_3	29.8 bc	24.7 cd	21.6 d	25.36 BC
T_4	30.4 bc	27.3 c	24.3 cd	27.33 BC
T_5	36.5 a	30.0 bc	28.7 bc	31.73 A
Mean	31.36 A	26.43 B	24.03 C	

Table 7 depicts maximum number of leaves per cutting (84.2) in T_5 (Garden soil + Sand + FYM + Peat moss) with V_1 (Coratina), followed by 82.3 at T_2 (Garden soil + Sand + Peat moss) and T_4 (FYM + Sand + Garden soil) in V_1 (Coratina), respectively. Maximum mean number of leaves per cutting, i.e., 77.3, were produced with T_5 (Garden soil + Sand + FYM + Peat moss), while maximum mean number of leaves (81.31) were attained by V_1 (Coratina), respectively.

Table 7: Effect of different media on number of leaves per cutting of olive varieties.

	V1	V2	V3	Mean
T_0	79.1 b	58.9 e	55 ef	64.33 D
T_1	80.1 b	65.6 cd	62.6 d	69.43 C
T_2	82.3 ab	72.1 c	71.9 c	75.43 B
T_3	79.9 b	62.1 d	60.2 de	67.4 CD
T_4	82.3 ab	71.5 c	69.8 cd	74.53 B
T_5	84.2 a	75.3 bc	72.4 c	77.3 A
Mean	81.31 A	67.58 B	65.36 B	

The results of these experiments illustrate the maximum growth of olive cuttings in terms of survival, root number, root length, shoot number, shoot length and number of leaves at T_5 (Garden soil + Sand + FYM + Peat moss). Coratina performed best in terms of rooting parameters, which may be due to the genetic make-up of the variety. The physiological stage of plant influences the rooting and rooting process. Rooting of plants is associated with the activities in cambium tissues, movements and synthesis of photosynthates and other substances, which help in root initiation and further development. The phenomenon of root development has three phases: meristem cells initiation, i.e., root initiation, differentiation into root primordial and emergence and development of roots including connection of vascular tissues with conducting tissues (Alam and Sajid, 2017). The rooting media affects the percentage of survived cuttings and also influences the quantity and quality of roots (Dolor*et al.,* 2009). The increased number of shoots might be due to intense rooting system, which helps in maximum nutrient uptake under the effect of IBA. This may also be due to more root number and intense plant growth (Kaurand Kaur, 2017).This might also be due to the availability of moisture or air in rooting media (Abdel-Mohsen, 2015). Less rooting percentage may be due to highly water saturated as well as less porosity of propagation media (Isfendiyaroglu *et al.,* 2009). Rooting ability of the stem cuttings is influenced by age of donor plant, position of cutting and IBA treatment (Borpuzari and Kachari, 2018).

CONCLUSION

The results of this study demonstrated the importance of growth media and its influence on survival, shooting and rooting of a plant. Rooting can be increased by carefully managing the propagation media characteristics of adequate aeration, physical structure, water holding capacity, lower bulk density, etc.

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