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# Propagation of Olive Cultivars through Air Layerage

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***Abstract:*** *An experiment "Propagation of olive cultivars through air layerage" was conducted at Agricultural Research Institute Tarnab Peshawar Pakistan during year 2011. The experiment was laid out in Randomized Complete Block (RCB) designs with split plot arrangement. Factor A was olive cultivars (Coratina, Baincullela, Frantoio) kept in main plot, while different bark size (2cm, 3cm, 4cm and 5cm) were allotted to sub plot. A significant variation was recorded for all parameters studied at different bark size for air layering in olive cultivars. The olive cultivars significantly influenced root length (cm) whereas, the interaction of olive cultivars and different bark also showed a significant variation for parameters. The maximum days to root appearance (47) and roots plant$^{-1}$ (12.56) were recorded in 5 cm bark removed. Whereas, the minimum days to root appearance (40) and roots plant$^{-1}$ (7.90) were recorded in 3 cm and 2 cm bark removed respectively. However, the highest root length (6.52 cm), root weight (2.94 g), percent plant survival (85.55 %) was recorded in 3 cm bark removed and root volume (1.17 ml) in 4 cm bark removed. By contrast the lowest highest root length (5.52 cm) was observed in air layered branches in 2 cm bark removed, root weight (1.86 g), percent plant survival (68.88 %) in 4 cm bark removed and root volume (0.91 ml) in 5 cm bark removed. Among various olive cultivars, the highest root length (6.25 cm) was observed for cultivar Coratina, while the lowest root length (5.40 cm) was recorded in cultivar Baincullela. In response to interaction effect the maximum days to root appearance (49) and roots plant$^{-1}$ (17.70) was recorded for cultivar Baincullela in 5 cm bark removed. Whereas, the minimum days to root appearance (36) for the cultivar Coratina was recorded in 3 cm bark removed and roots plant$^{-1}$ (17.70) for cultivar Baincullela in 5 cm bark removed. Cultivar Coratina was observed with the highest root length (8.25 cm) in 3 cm, root volume (1.44 ml) in 4 cm and percent plant survival (90.00 %) in 3 cm bark removed. However, the lowest root length (3.43 cm) was recorded in 2 cm bark removed and root volume (0.84 ml) for both cultivars in 5 cm bark removed. Similarly, the lowest root weight (1.82 g) and percent survival (58.30 %) was recorded in 4 cm bark removed for cultivars Baincullela and Frantoio respectively. It was concluded from present data that Coratina performed best in root development through air layerage, when 3 cm bark removed under the climatic conditions of Peshawar.*

## I. Introduction

Olive (Oleaeuropaea L.) belongs to family Oleaceae. Olive is an attractive evergreen tree with grey-green foliage. It is a slow and steady growing tree having a long life of about 900 to 1000 years. It can reach a height up to 15 m or more. It was under cultivation long before the time of earliest recorded history, originated in the Eastern Mediterranean area. The cultivation in Italy, Spain and North Africa began later than in the Eastern Mediterranean region. In Asia, cultivation is confined to Iraq, Iran and China (Simmonds, 1976).

Olive growing plays an important role in the economy of a country. It can be grown in marginal and waste land, where the soil is unsuitable for other crops. It increases the land value. It contributes to soil conservation and helps to combat problems of the environmental degradation and desertification. It provides employment opportunities to the rural population and thus helps in poverty alleviation. A large number of olive groves are owned by small holders in the olive growing countries; who earn enough for the betterment of their livelihood. Moreover, olive products help to satisfy the nutritional needs of the population. Ripe olive fruits are pressed for rich oil which is the best oil available in the world for edible purposes. The olive oil has twice as much energy value than sugar. The fruit contain around 20% oil and has very less cholesterol. Olive fruits contain 80% unsaturated fatty acid compared with 20% saturated ones. Olive oil contains high percentage of oleic acid which is very essential for our body. The olive oil is used for cooking, salad dressing, food

preparation, massage and for the manufacture of cosmetics, pharmaceuticals, etc. Mature fruit are also eaten after being processed and preserved in vinegar or salt solution (Pietro and Carlo, 2002).

Olive is successfully grown in a climate having moderate cold winters and prolonged hot summers with low humidity. Temperature below $10^{o}$C is injurious as it may kill the plant. Winter rest is considered essential for fruit bud differentiation. Most cultivars require at least two months of winter chilling for floral bud initiation. It is one of the most drought resistant trees and thrives well where the annual average rainfall is around 900-1000 mm without irrigation. It grows well on many different kinds of soil, ranging from rocky shallow hillsides to deep fertile valley soils, from acid soils to fairly alkaline soils. It can also tolerate considerable salinity too. However it can't withstand poorly drained soils and quickly dies if water stands around its roots for few weeks (Munir, 2009).

Olive is propagated through sexual and asexual means. Propagation of olive through sexual mean is usually not recommended, because seedlings are not true to type and take a lot of time to bear fruit. Asexual or vegetative propagation methods probably the most widely used commercial method of propagation in olive. Asexual propagation methods also include cutting, budding, grafting and air-layering. Air-layering is usually done in the months of June, July and August. Branches from well developed trees, free from pests and diseases are selected for air-layering. A branch of 5-10 mm in diameter is selected and bark of ½-1 inch is removed, covered with soil and any other rooting medium and then wrapped with polythene film. When a good ball of roots develop, the branch is then cut off below the wrapped position after which it is generally placed in a larger box or a tub or a pot to become more firmly established before being set out permanently (Wilson, 1920).

Air layering is a method which was originated by the Chinese several centuries ago. Basically it is a method of producing plants from aerial branches which remained attached with parent plant while rooting. Some plants which are difficult to root, air layering has been proven as an effective method in a wide range of species as a means of increasing their kind. The moist medium for rooting is usually placed around the wounded area of the branch. It is held in position by placing a wrapping around the periphery of the ball of the medium. After the roots have grown to the outside of the ball of medium, the branch is removed and planted in a pot on its own roots. The growth, establishment and survival of branches and seedlings also depend on the quality of a growing medium. There are many commercial growing media used to raise seedlings and branches, but many are expensive and locally unavailable. There is a need to establish appropriate and low cost growing media to ensure that the tree seedlings could attain a suitable size for layering within a year. Amending growing media with fertilizer can promote seedling and branching growth, establishment and survival (Sileshi et al, 2007).

Olives have not been traditionally grown in Pakistan for the edible oil production, although few grooves existed both in the plain and hilly areas. The oldest cultivation was established in the 1970's. Therefore no scientific approach has been developed for their proper management and very limited research studies have been carried out on olive in this part of the world. Due to recent establishment of olive cultivation, very little information is available about the appropriate cultural practices to obtain economic yield under the diverse agro-climatic conditions. Beside this the plantation of wild olives (Oleacuspidata and Oleaferrugenea) can be seen in many areas of Pakistan. Its natural vegetations is abundantly found in Malakand division, Kohat, Mardan, Cherat, Karak and Hazara divisions of Khyber Pakhtunkhwa and Potohar area of Punjab and some parts of Balochistan. The wild plantation indicates that agro-climate of these areas, suitable for its commercial cultivation.

**Objectives**

1. The present study is initiated to find out optimum bark size removal in air layering.
2. To determine best cultivar of olive for air layering under the agro-climatic conditions of Peshawar.
3. To find out the interactive effect of bark removal and cultivars of olive for air layering.

## II. Materials And Methods

An experiment to investigate the "Propagation of olive cultivars through air layerage" was conducted at Olive Research Field, Agricultural Research Institute (ARI) Tarnab Peshawar during 2011. The experiment was laid out in Randomized Complete Block (RCB) designs with split plot arrangements having three replications. The olive cultivars i.e, Coratina, Baincullela and Frantoio were allotted to main plot while, different bark size of (2 cm, 3 cm, 4 cm and 5 cm) were assigned to sub-plots. There were five air-layers for each sub plot and thus 60 layers were made in one replication. All the air layerage of olive cultivars was practiced in the month of July 2011 having humidity 80% in the atmosphere.

A circular strip of bark having different size (2 cm, 3 cm, 4 cm and 5 cm) removed from one year old and healthy shoots. The plants used in the experiment were seven years old . A well prepared media having FYM, clay and silt in equal ratio was tightly wrapped around each layered branch in transparent plastic. All the air layered plants were frequently irrigated after the completion of air layering practice. The branches which showed successful development of roots in burlap had carefully removed from parent plants and kept under

partial shade for couple of weeks to become hardened. All other cultural practices were kept uniform for all the treatments during this course of experiment.

The experiment composed of the following two factors:

| **Factor A (Cultivars)** | | | **Factor B (Bark sizes removal)** | | |
|---|---|---|---|---|---|
| $CV_1$ | = | Coratina | $B_1$ | = | 2 cm |
| $CV_2$ | = | Baincullela | $B_2$ | = | 3 cm |
| $CV_3$ | = | Frantoio | $B_3$ | = | 4 cm |
| | | | $B_4$ | = | 5cm |

The data on following different growth parameters were carefully recorded accordingly:

**Number of days to root appearance**

Number of days to root appearance after the date of air-layering was observed and recorded in each replication and average was worked out.

**Number of roots plant$^{-1}$**

Data was recorded by cutting air layered shoots, and the media attached with roots was removed by washing with water and the number of root per air layered shoot/plant was counted and the average was worked out.

**Root Weight (g)**

Data was recorded by cutting air layered shoots ,and the media attached with roots was removed by washing with water and weighed the roots per air layered shoot/plant was counted and the average was worked out.

**Survival Percentage**

At the end of experiment, the plants were counted and survival percentage was recorded by the following formula:

$$\text{Percent plant survival} = \frac{\text{Number of survived Plants}}{\text{Total number of plants}} \times 100$$

**Statistical Analysis**

The recorded data were statistically analyzed according to the procedures relevant to RCB design with split plot arrangement. Upon significant results, least significance difference (LSD) test was used for means comparisons to identify the significant components of the treatment means (Jan et al., 2009).Statistical computer software, MSTATC (Michigan State University, USA) was applied for computing both the ANOVA (Analysis Of Variance) and LSD (Steel and Torrie, 1980).

## III. Results And Discussion

**Days to root appearance**

Data regarding days to root appearance are presented in Table-I, while, the analysis of variance in Table-Ia. Days to root appearance were significantly affected by different size of bark removal, whereas, the olive cultivars and its interaction with different sizes of bark removal had non-significant effect on days to root appearance.

The different size of bark removal significantly influenced the days to root appearance in olive propagation through air layering. The highest number of days to root appearance(49) of olive cultivars was recorded at 5 cm bark removal through air layering that were statistically at par with 2 cm (46.00) and 4 cm (39.33) bark removal. However, the lowest number of days (36) was taken by olive plants when 3 cm bark removed from layered branch.

Roots are considered one of the most important components for plants and play a key role in nutrient uptake and provided a mechanical support to plants, since it was observed that number of days to root appearance was significantly affected by bark size removal when olive cultivars were propagated through air layering. The maximum numbers of days to root appearance were taken by cultivar Baincullela at 5 cm bark removal.

The findings of Butt et al., (1996) resemble with the present findings, who found that the number of days to root appearance were more in olive cultivar Baincullela because of its genetic makeup. Similar results were also presented by Rafi and Abrar (2010), who reported that cultivar Baincullela, took the highest number of days to root appearance. Similarly the significant response of olive cultivars to the removal of different bark sizes in number of days to rooting might be due to the reason that the wounded area exposes more of the cambium and increases the development of the callus tissue and roots. Removal of bark is infact removal of phloem, the air layered branches still obtain water and nutrients through the xylem vessel. Photosynthates accumulate above the girdled area and this stimulates the development of callus tissue from which roots develop.

**Table I. Effect of bark size removal on days to root appearance of olive cultivars through air layering**

| | Bark | | | | |
|---|---|---|---|---|---|
| **Cultivars** | **2 cm** | **3 cm** | **4 cm** | **5 cm** | **Mean** |
| Coratina | 46 | 36 | 43 | 46 | 42.75 |
| Baincullela | 49 | 39 | 46 | 49 | 45.75 |
| Frantoio | 39 | 45 | 41 | 47 | 43.00 |
| Mean | 44.67ab | 40.00b | 43.00ab | 47.33a | |

LSD value for bark removal at 5 % level of probability = 4.391
LSD value for interaction at 5 % level of probability = 7.605

**Roots Plant$^{-1}$**

Data regarding number of roots plant$^{-1}$ are presented in Table-II, while the analysis of variance in Table-IIa. Number of roots plant$^{-1}$ was significantly affected by different sizes of bark removal. Cultivars did not show any significant influence on roots plant$^{-1}$. However, the interaction between different sizes of bark removal and the cultivars significantly affected the number of roots plant$^{-1}$ (Table-IIa).

Mean table shows that maximum number of roots plant$^{-1}$ (12.6) was recorded in plants at 5cm of bark removal. The bark removal significantly influenced the number of roots plant$^{-1}$.It indicated that the highest number of roots was observed when 5 cm bark removed. In this case an optimum area has been exposed for root development and thus resulted a high number of roots plan$^{-1}$. The remaining three bark removal sizes i.e. 2 cm, 3 cm and 4 cm are statistically similar to each other. As for as interaction effect, significant variation in root plant$^{-1}$ was observed and the highest number of roots plant$^{-1}$ (17.70) were produced by cultivar Baincullela at 5 cm bark removal. The Cultivar Coratina at 3 cm bark removal was observed with the lowest number of roots plant$^{-1}$ (4.70).

The findings of Awanet al., 2002 support our results. The combination of the garden soil enriched with nutrients, increased water holding capacity and proper aeration probably provided an ideal environment to cultivar Frantoio to have more roots plant$^{-1}$. Similar results had been obtained that besides growth regulators, varying quality of visible light influences many physiological processes of the plants.

**Table II.Effect of bark size removal on roots plant$^{-1}$of olive cultivars through air layering**

| | Bark | | | | |
|---|---|---|---|---|---|
| Cultivars | 2 cm | 3 cm | 4 cm | 5 cm | Mean |
| Coratina | 5.00 | 4.70 | 11.00 | 12.00 | 8.16 |
| Baincullela | 7.66 | 8.00 | 5.00 | 17.70 | 9.58 |
| Frantoio | 11.00 | 12.00 | 7.70 | 8.00 | 9.66 |
| Mean | 7.90 b | 8.23 b | 7.90 b | 12.56 a | |

LSD value for bark removal at 5 % level of probability = 1.394
LSD value for interaction at 5 % level of probability = 2.414

**Root Weight (g)**

Data regarding root weight is presented in table-III and the analysis of variance in Table-IIIa. Data shows that root weight was significantly affected by different size of bark removed and the interaction of bark and cultivars, however the effect of cultivars were non significant.

Mean table shows that the maximum root weight (2.94 g) was recorded in plants having 3cm of bark removed while, the minimum root weight (1.86 g) at 4cm of bark removal that was statistically at par with root weight of 2 cm and 5 cm bark removal.

In the interactive effect of cultivars and different size of bark removal, the heaviest roots (3.50 g) were produced by cultivar Coratina at 3 cm bark removal and the lightest root weight (1.82 g) was recorded at 4 cm bark removal in cultivar Frantoio.

Significant variation in root weight may probably be due to significant variation in root length and root volume ofolive cultivars. It might have been due to the development of excellent root system. While on other hand Frantoio having small root length but more weight, it may be more energy intensive in their root system and higher apical meristematic activities and cambial cell division too. It also reflects that these two olive cultivars might have provided favorable physical conditions for sufficient nutrients access to the cuttings which are needed for activating enzymatic and biochemical processes.

**Table III. Effect of bark size removal on root weight of olive cultivars through air layering**

| Cultivars | Bark | | | | Mean |
|---|---|---|---|---|---|
| | 2 cm | 3 cm | 4 cm | 5 cm | |
| Coratina | 2.10 | 3.50 | 1.88 | 1.93 | 2.17 |
| Baincullela | 2.00 | 2.79 | 1.90 | 1.85 | 2.31 |
| Frantoio | 1.89 | 2.53 | 1.82 | 1.97 | 2.05 |
| Mean | 1.99 b | 2.94 a | 1.86 b | 1.91 b | |

LSD value for bark removal at 5 % level of probability = 0.265
LSD value for interaction at 5 % level of probability = 0.459

**Percent Plant Survival (%)**

Data pertaining to percent plant survival is presented in Table-IV while, the analysis of variance in Table-IVa. Table-IV revealed that percent survival was significantly affected by different size of bark removal, while various cultivars of olive did not show any significant response in percent plant survival (%). However the interaction between various cultivars and bark removal significantly influenced percent plant survival.

The highest percent plant survival (85.55) was recorded at 3 cm bark removal closely followed by percent plant survival (84.44) at 5 cm and percent plant survival (79.21) at 2 cm bark removal. However, plants at 4 cm bark removal through air layering was recorded with the lowest percent plant survival (68.88).

In case of interaction cultivar Coratina and Frantoio were recorded with the highest percent plant survival (90.0) at 3 cm and 4 cm respectively. By contrast the lowest percent plant survival (58.30) was recorded in cultivar Baincullela, and Frantoio at 2 cm bark removal is (67.65).

The variation among various olive cultivars with regards to the percent plant survival could be referred to the genotypic adaptabilities of regeneration and survival in our agro-climate. There are also higher percentages of perfect flowers in Frantoio and similar was reported by Seifiet al. (2008) in the comparison of olive cultivars, Manzanillo, Mission and Frantoio. While according to Palliottiet al., (1996) evaluated the comparison olive cultivar, Moraiolo, San Felice and Frantoio for productive characteristics and reported that the numbers of inflorescences per shoot node were similar. But Fruit Yield tree$^{-1}$ and fruit weight were higher in Frantoio.

**Table IV. Effect of bark size removal on percent plant survival (%) of olive cultivars through air layering**

| Cultivars | Bark | | | | Mean |
|---|---|---|---|---|---|
| | 2 cm | 3 cm | 4 cm | 5 cm | |
| Coratina | 83.30 | 90.00 | 58.38 | 85.00 | 79.17 |
| Baincullela | 86.70 | 86.50 | 58.30 | 81.70 | 78.30 |
| Frantoio | 67.65 | 80.00 | 90.00 | 86.70 | 81.08 |
| Mean | 79.21 a | 85.55 a | 68.88 b | 84.44 a | |

LSD value for bark removal at 5 % level of probability = 8.156
LSD value for interaction at 5 % level of probability = 14.127

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