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GROWTH RESPONSE OF VARIOUS OLIVE CULTIVARS TO DIFFERENT CUTTING LENGTHS

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Abstract

The experiment was conducted to study growth response of 5 olive cultivars to different cutting lengths at Agricultural Research Institute Tarnab, Peshawar. Hardwood stem cuttings of 15, 20, 25, 30 and 35cm were taken from cultivars Azarbaijan, uslu, Improved Nabali, Manzallino and Leccino. Maximum number of shoot (5.51), shoot length (22.29cm), root length (12.60cm) and survival (65.55%) were recorded by cultivar Azerbaijan at 20cm cuttings length, while early day to sprouting (33.24) and maximum number of roots (15.39) were found in cultivar Azarbaijan at 15cm cuttings length.

Introduction

Olive (*Olea europea* L.) 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 (Seyhan & Gezerel, 2005). Commercial production of olive is found in belts around the world between 30^o - 45^o north and south of equator. Pakistan is located in the same region have varied climatic and soil factors, due to which all sort of tropical, subtropical and temperate zone fruit trees can be grown. Olive being a sub-tropical can be grown successfully in the subtropical mountainous region of Khyber Pakhtoon Khwa and Balochistan (Baloch, 1994). Cutting is simple and rapid method of propagation to maintain genetic uniformity and come into bearing earlier than those raised from seeds. The yield is uniform and stable in vegetative propagated plants. Olive can be propagated by hard wood or semi hard wood cuttings (Hartmann *et al*., 2002, Fabbri *et al*., 2004). The length of cuttings were varies between 15-25cm depending on the cultivar. The cuttings are then treated with IBA (Indole Butyric Acid). Seyhan & Gezerel, (2005) studied that dipping the cuttings in 2000, 4000 and 6000ppm. IBA increased the number of roots formed; the effect gradually increases with IBA concentration. It was found that above concentration of IBA given the highest survival percentage of rooted cuttings to different cultivars. Murat & Elmas (2008) observed maximum rooting and field survival in 20cm long semi-hardwood cuttings treated with IBA 5000ppm. Awan *et al*., (2001) studied 20-25cm long cuttings of Azarbaijan, Earleeg, Leccio, Corentina and Sufiada. It is observed that Azarbaijan and Earleeg showed significantly maximum numbers of leaves per cutting and shoot length. Azarbaijan showed high sprouting percentage and number of shoot. The shoot diameters were not significantly different in either variety. Rehman *et al*., (2002) observed hard wood cuttings of variety Corantina with 3000ppm concentration of IBA resulted in maximum root number, root length, rooting percentage, and survival percentage and shoot length as compared to the control treatment. Abousalim & Mansouri (1991) conducted experiments on semi hard wood cuttings of olive cultivars Picholine and Marocanie, taken in autumn, and propagated in 3x6x0.4m trench covered with transparent plastic film and a 10cm layer of sand and gravil rooting medium was placed on the top. The rooting medium consisted of yellow and sphagnum peat+ yellow sand. A relatively humidity was maintained 95-97% inside the propagator. The temperature of the substrate varied between 17.2 - 20.7C. The cuttings were treated with 4000mgL + 25% Capton before being placed in the rooting medium. The highest rooting percentage of 95% was obtained from cutting taken from the meddle pats of shoot and rooted in yellow sand. Rooting was least successful for apical auxiliary cutting in either rooting medium. Haq *et al*., 2009 reported significantly increase 95.33% rooting of tetra nodal micro-cuttings with 125ppm IBA application. The number of nodes on the cuttings also have significantly positive effect on root growth and development.

The present study was conducted with the aim to find out best cultivar at best suitable cutting length in the agro ecological condition of Peshawar valley.

Materials and Methods

This experiment on growth response of various olive cultivars to different cutting's length was conducted at Agricultural Research Institute, Tarnab, Peshawar during 2001. The experiment was carried out in randomized complete blocked design with split plot arrangement replicated 4 times. Olive cultivars were allotted to main plot while hard wood stem cutting lengths to sub plots. Hard wood stem cuttings of different lengths i.e., 15, 20, 25, 30 and 35cm were taken from 5 diiferent cultivars Azarbaijan, Uslu, Improved Nabali, Manzallino and Leccino. The cuttings were taken from 1-3 years old branches of olive trees in the month of March. These cuttings were treated with 3000ppm IBA solution for 5 second and then buried in soil trenches for callus formation at the tips of the cuttings. In the first week of April the cuttings were removed from the trenches and simultaneously transplanted into already prepared nursery beds.. A distance of 5cm was maintained between cuttings while rows to row distance was kept 45cm. The cuttings were planted with the help of dipper and two-third portion of the cuttings were buried in the soil. All the cuttings were covered with nylon shade cloth for partial shade.

The recommended cultural practices were applied uniformly during the whole experiment.

Results and Discussion

Days to sprouting: Data regarding days to sprouting are presented (Table 1). Statistical analysis of the data indicated that there is a significant difference among cultivars and cutting length. The interactions between the 2 factors were also significant. Uslu cultivar sprouted earlier (36.05) followed by Azarbaijan (36.88), while maximum of 39.74 days to sprouting were taken by Leccino. In case of cutting length, maximum days to sprouting (38.79) were taken by 35cm cutting while minimum days to sprouting (35.35) were taken by 15cm cutting. In case of interaction between the 2 factors indicated that Azarbaijan sprouted earlier (33.24 days) with 15cm cuttings length, while cultivar Leccino sprouted later (41.75 days) with 35cm length, used. This variation in the sprouting is due to the fact that both cultivar and length had contributed significantly. All the cultivars sprouted earlier when the smallest (15cm) lengths were used. While Shakir *et al.*, (2004) also recorded similar results in cultivated and wild olive cuttings.

Table 1. Days to sprouting in response to different cutting's lengths in olive cultivars.

Cultivars	15cm	20cm	25cm	30cm	35cm	Mean
Azerbaijan	33.24 k	37.48	38.43	37.52	37.74	36.88 c
Uslu	34.95	35.72	36.43	36.87	36.28	36.05 d
Improved Nabali	35.03	37.47	37.76	38.41	39.20	37.57 b
Manzallino	34.90	36.30	36.32	38.47	38.97	36.99 c
Leccino	38.62	38.07	39.62	40.66	41.75 a	39.74 a
Mean	35.35 d	37.01 c	37.71 b	38.38 a	38.79 a	

LSD value (0.05) for cultivar = 0.5
LSD value (0.05) for cutting length = 0.5
LSD value (0.05) for cultivar x length = 0.5
Means followed by the same alphabetical letter are statistically non-significant (0.05) according to LSD test.

Number of shoot plant^{-1}: Azarbaijan cultivar recorded maximum number of shoot plant^{-1} 4.27 (Table 2), followed by Leccino 4.17, while minimum number of shoot plant^{-1} 3.90 was recorded by Uslu cultivar. In case of cutting length highest number of shoot plant^{-1} 5.30 was observed in 20cm cutting length, followed by 25cm cutting length 4.49, while lowest number of shoot plant^{-1} 3.58 was recorded in 30cm cutting length. For interaction between the two factors indicated that Cultivar Azarbaijan, Leccino and Uslu produced maximum number of shoot 5.51, 5.43 and 5.38 with 20cm cuttings length , while cultivar Uslu produced minimum number of shoot (2.65) with 35cm length was used. This may due to the fact that more area for shooting was there in 20cm length as compared to 15cm length, while in the remaining lengths the area were greater than 20cm, but those lengths could not maintain themselves because of the higher transpiration. These results are lower in range from Shakir *et al.*, (2004) who recorded upto 8.30 maximum number of shoots plant^{-1}.

Table 2. Number of shoot in response to different cutting's lengths in olive cultivars.

Cultivars	15cm	20cm	25cm	30cm	35cm	Mean
Azarbaijan	4.28	5.51 a	4.56	3.65	3.33	4.27 a
Uslu	3.51	5.38 a	4.39	3.54	2.65 g	3.90 c
Improved Nabali	4.13	5.27	4.59	3.59	2.85	4.09 a b c
Manzallino	3.51	4.29	4.35	3.60	3.46	3.97 b c
Leccino	4.50	5.43 a	4.57	3.53	2.79	4.17 a b
Mean	3.99 c	5.30 a	4.49 b	3.58 d	3.02 e	

LSD value (0.05) for cultivar = 0.1997
LSD value (0.05) for cutting length = 0.1997
LSD value (0.05) for C x L = 0.45

Shoot length: Shoot length plant^{-1} (Table 3) was significantly affected by different cultivars, cutting lengths and also in the interaction between cultivars and lengths. Azarbaijan produced maximum shoot length (17.50cm) followed by improved nabali 17.01, while minimum shoot length 14.90 cm was produced by manzallino. Cutting length of 20cm produced highest shoot length 2.16cm followed by 25cm cutting length 18.28cm, while lowest number shoot length 15.80cm was recorded by 30cm cutting length. In case of interactions between the 2 factors indicated that cultivar Azarbaijan produced maximum shoot length 22.29cm with 20cm cutting's length were used, while cultivar Leccino produced minimum shoot length 8.43cm with 35cm cutting length. This may be due to the fact that there was a competition among more shoots (as respond earlier) and have tried to capture more resources, hence got maximum shoot length. The Shakir *et al.*, (2004) recorded 25.97cm maximum shoot length which is 3.68cm more long then maximum shoot length results obtained from cultivar Azarbaijan.

Table 3. Shoot length (cm) in response to different cutting's lengths in olive cultivars.

Cultivars	15cm	20cm	25cm	30cm	35cm	Mean
Azarbaijan	17.32	22.29 a	19.58	17.24	11.07	17.50 a
Uslu	17.09	20.30	18.48	15.99	8.76	16.12 c
Improved Nabali	18.29	21.04	18.71	15.03	11.99	17.01 a b
Manzallino	13.74	21.26	15.55	13.55	10.70	14.90 d
Leccino	18.37	20.91	19.37	17.18	8.423 n	16.85 b
Mean	16.96 c	21.16 a	18.28 b	15.80 d	10.19 e	

LSD value (0.05) for cultivar = 0.5,
LSD value (0.05) for cutting length = 0.5
LSD value (0.05) for cultivar x length = 1.104
Means followed by the same alphabetical letter are statistically non significant (0.05) according to LSD test.

Number of root plant^{-1}: The numbers of root plant-1 were significantly different in cultivars (Table 4), lengths and also in the interaction between cultivars and lengths. Highest number of roots plant^{-1} was produced by Azarbaijan 11.76, while lowest number of roots plant^{-1} was recorded by Manzallino 8.46. 15cm cutting length resulted in maximum number of roots 13.43, followed by 20cm cutting length 11.25, while 35cm cutting length resulted in minimum number of roots plant^{-1} 6.40. Interaction between the Cultivar and cutting length revealed that Azarbaijan produced maximum number of roots 15.39 with 15cm cutting's lengths; while cultivar Improve Nabali produced minimum number of roots 5.66 with 35cm cutting length was used. This may be due to the fact that shorter length had no stress such as higher transpiration. Despite the relatively high rooting rates of IBA treated cuttings, the number and length of roots give different results as previously reported by İsfendiyaroğlu & Özeker, (2000).

Table 4. Number of root in response to different cutting's lengths in olive cultivars.

Cultivars	15cm	20cm	25cm	30cm	35cm	Mean
Azarbaijan	15.39 a	13.83	13.16	8.79	7.65	11.76 a
Uslu	14.36	10.55	7.20	6.66	6.45	9.05 d
Improved Nabali	13.82	11.40	9.33	9.62	5.66 n	9.97 b
Manzallino	10.44	10.06	8.31	7.62	5.87	8.46 e
Leccino	13.16	10.42	9.50	7.83	6.38	9.64 c
Mean	13.43 a	11.25 b	9.50 c	8.11 d	6.40 e	

LSD value (0.05) for cultivar = 0.34,
LSD value (0.05) for cutting length = 0. 34,
LSD value (0.05) for cultivar x length = 0.8

Root length: The root length was significantly different in cultivars (Table 5), cutting lengths and also in the interaction between cultivars and lengths. Azarbaijan produced maximum root length 8.73cm, followed by Leccino 8.67, while improved Nabali resulted in lowest root length 7.78. For cutting length maximum of 11.24 root length was recorded by 20cm cutting length, while 35cm cutting length resulted in minimum root length 5.20. In case of interaction between the 2 factors suggested that cultivar Azarbaijan produced maximum root length 12.60cm when 20cm cutting's lengths, while cultivar Uslu produced minimum root length 4.40cm with 35cm length was used. Maximum root length may be due to root and shoot ratio (maximum response of shoot length). Root length grows downward and is very effective in absorbing moisture and nutrient for plant growth. The results are not in line with Shakir *et al.*, (2004) who found maximum root length 7.01 in 15cm cutting length.

Table 5. Root length (cm) in response to different cutting's lengths in olive cultivars.

Cultivars	15cm	20cm	25cm	30cm	35cm	Mean
Azarbaijan	8.28	12.60 a	8.99	7.66	6.13	8.73 a
Uslu	7.79	10.77	8.97	6.98	4.40 n	7.78 c
Improved Nabali	7.87	11.29	9.60	7.87	5.06	8.34 b
Manzallino	8.89	10.15	9.54	8.48	5.06	8.43 a b
Leccino	8.34	11.38	9.55	8.72	5.39	8.67 a
Mean	8.23 c	11.24 a	9.33 b	7.94 c	5.20 d	

LSD value (0.05) for cultivar = 0.3
LSD value (0.05) for cutting length = 0.3
LSD value (0.05) for C x L = 0.7
Means followed by the same alphabetical letter are statistically non significant (0.05) according to LSD test

Plant percent survival: Data regarding plant percent survival is reported (Table 6). Perusal of the data showed that plant percent survival was significantly different in cultivars, cutting lengths and interaction between cultivars and lengths. Azarbaijan resulted in maximum plant survival 56.88%, followed by Leccino 55.11%, while improved Nabali resulted in lowest plant survival 47.25%. 20cm cutting length resulted in maximum plant survival 60.66%, followed by 15cm 59.06, which is statistically at same level with that of 20cm. Minimum plant survival of 33.77% was recorded by 35cm cutting length. In case of interaction between Cultivars and cutting length indicated that cultivar Azarbaijan plant survival 65.55% in plant 20cm cuttings length, while cultivar Improve Nabali had minimum plant survival 18.89% with 35cm length. This variation in the plant survival may due to the fact that both cultivar and length had contributed significantly better for most of the parameters like shoot length, number of shoot and root length. Similar results were reported by Shakir *et al.*, (2004) who investigated maximum plant survival 36.29% in 15cm cutting length and in cultivar *olea euroeae* (38.64%) as compared to *olea cuspidate*.

Table 6. Percent plant survival in response to different cutting's lengths in olive cultivars.

Cultivars	15cm	20cm	25cm	30 cm	35cm	Mean
Azarbaijan	61.11	65.55 a	56.66	52.22	48.88	56.88 a
Uslu	56.66	61.11	55.55	47.77	36.66	51.55 c
Improved Nabali	58.66	58.89	51.11	48.69	18.89 k	47.25 d
Manzallino	58.89	58.89	55.55	28.89	21.11	44.66 e
Leccino	60.00	58.89	57.78	55.55	43.33	55.11 b
Mean	59.06 a	60.66 a	55.33 b	46.62 c	33.77 d	

LSD value (0.05) for cultivar = 1.7
LSD value (0.05) for cutting length = 1.7
LSD value (0.05) for C x L = 3.8

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