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Effects of the Season on the Rooting Performance on the Local Olive Types of Northern Cyprus

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ABSTRACT

In this study, rooting performance of cuttings of local olive types of Northern Cyprus taken in spring and autumn seasons was investigated. Gemlik Olive cultivar was used as the control group and 14 different local olive types constituted the experimental groups. Green cuttings taken from local olive types were initially treated with 4000 ppm indole-3-butyric (IBA) and they were then rooted in perlite medium under fogging unit in a plastic greenhouse. Following 100-days of rooting, rooting ratios, root lengths, number of roots and shooting ratios were determined. As expected, the best rooting ratio was obtained from Gemlik Olive cultivar (control group). Among the local types, the best rooting ratio (58.67%) was obtained from Çamlıköy with Type 8 olive type and the best rooting performance (45.87%) was achieved in cuttings rooted in autumn season.

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Introduction

Olive is the among the oldest fruit trees of the world. According to all classical sources, olive occupies a quite important place due to its use as oil and fruit by many peoples in Mediterranean Civilizations. Mediterranean climate and soil structure are among the most suitable factors for olive culture worldwide (Kaplan and Arıhan, 2011; Kuçukkomurler, 2011; Afzal et al., 2017; Güler et al, 2017; Dalla Rosa and Villa, 2018). Botanists consider Cyprus as the second homeland of olive. Especially in Kalkanlı district of Northern Cyprus, there are several monumental olive trees with the estimated ages of between 1000 – 1500 years, there are even monumental olive groves (Tozlu, 2007; 2011).

Besides seed propagation, olive trees can also be propagated vegetatively from oleaster, nodule, foliated scions and sucker shoots (Ullah et al., 2012; Thakur et al., 2016; Güler et al., 2017; Dalla Rosa and Villa, 2018; Gül and İsfendiyaroğlu, 2019). When the proper techniques were employed, shoots and branches are considered as perfect production materials (Fabbri et al., 2004; Afzal et al., 2017). On the other hand, long time is required to get grafted saplings from seed-propagated plantlets. The cost of such saplings is also high and thus ever-increasing sapling demands are not able to be met (Gül and İsfendiyaroğlu, 2019).

In Northern Cyprus, olive production is very popular and is one of the most important crops in the sustainable horticulture in Cyprus. There are also some olives types not registered yet but long have been used in commercial productions for years. In recent years, Gemlik olive, which is a significant cultivar of Turkey, was brought to the Northern Cyprus to support the olive production of the island. Such efforts are still going on. In fact, performance of Gemlik olive under dry or irregular irrigation conditions is low as compared to some local olive types (Tozlu, 2011). Therefore, growers uproot this type of olive groves or turn them into local types through grafting.

Plant cutting is the most used method of vegetative propagation to produce high quality seedlings in olive propagation (Hechmi et al., 2013; Villa et al., 2017). Hardwood, leafy cuttings and semi-hardwood cuttings rooting are the most common sapling production techniques in olives (Ullah et al., 2012; Manish Thakur et al, 2016; Villa et al., 2017; Dalla Rosa and Villa, 2018; Gül and İsfendiyaroğlu, 2019). Such systems are also applied in Northern Cyprus. However, because of low rooting ratios of local olives from the cuttings, grafting on wild olive trees is mostly preferred in sapling production (Tozlu, 2011).

Despite the previous knowledge on troublesome rooting of local olive types of Northern Cyprus, the studies conducted on this issue are quite limited. In this study, better rooting periods of local olive types determined, and cutting-propagation method assessed as to determine if the method is a proper one for olive rooting.

Materials and Methods

Gemlik olive cultivar and 14 disease-free local olive types with a uniform structure, at full-yield stage and collected from different regions of Northern Cyprus constituted the plant material of the present study. While selecting the local olive types, long-term observations of the producers were taken into consideration and economically profitable and regularly maintained ones were tried to be selected (Table 1).

Table 1 The local olive types in Northern Cyprus and collecting regions

Type (T)	Region
Type 1	İskele
Type 2	İskele
Type 3	Lefke
Type 4	Lefke
Type 5	Cengizköy
Type 6	Cengizköy
Type 7	Çamlıköy
Type 8	Çamlıköy
Type 9	Lapta
Type 10	Lapta
Type 11	Güzelyurt
Type 12	Türkmenköy
Type 13	Türkmenköy
Type 14	Lefke

Spring (March) and autumn (October) seasons were preferred to collect cuttings and rooting processes. Scions taken from annual semi-hardwood shoots were cut into 20-25 cm pieces and bottom leaves were cleared as to leave 2-5 leaves over the upper sections of the cutting.

In the olive trees, Villa et al., (2017) reported that Auxin with indole-3-butyric acid (IBA) the most commonly used in rooting performance is limited factor for rooting performance. In the experiment, cuttings were dipped into 4000 ppm IBA solution for 10 seconds to improve rooting performance (Kurd et al., 2010; Penso et al. 2016; Dalla Rosa and Villa et al., 2017) and they were planted into perlite-containing rooting trays in a plastic greenhouse. Heating coils were placed over the bottom surface of the trays at 20 cm spacing to heat the rooting environment. Greenhouse indoor temperatures were monitored with a minimum-maximum thermometer. Fogging system was used for irrigation and digital control units were used to control indoor temperature and irrigations. Leaf wetness was also monitored with an electronic leaf sensor.

To prevent excessive heat up of the greenhouse in sunny days, 75% shading net was used. Mains were used to supply water to fogging system. A 5-ton water tank was used against water cuts and 1 HP electric booster pump was used to supply water pressure.

Experiments were conducted in 2 × 3 Factorial Experimental Design with 25 cuttings for each type and replicates. Spring and autumn rooting ratios (%), root lengths (mm), number of roots and shooting ratios (%) were determined.

For this experiment, the data was analyzed statistically by using statistical software TARIST program (Açıkgöz et al., 1994), Onto least significance difference (LSD) test have been used for means comparison to find out the significant components of the treatment means.

Results and Discussions

Rooting performances of cuttings taken from different local olive types of Northern Cyprus are provided in Table 1. With regard to rooting ratios, effects of olive types and periods (T and P) were found to be significant ($P<0.05$), but the effects of type × period interactions were not found to be significant ($P>0.05$). The greatest rooting ratio was observed in the control group, it was followed by T8 type (58.67%) and the lowest rooting ratio was observed in T4 type (18.67%) (Table 2). In a previous study conducted about the rooting ratios of Domat and Ayvalık Olive (*Olea europaea* L.) cultivars, the greatest rooting ratio of 3-bud scions was reported as 26.67% (Geraksis and Özkaya, 2005). In addition, Fabbri et al. (2004) reported that the highest rooting in the determination of the periodic performance of olive cuttings was obtained from the cuttings taken in April, September and October. As compared to previous studies, present local olive types exhibited greater performances than the average values. Considering the periods, autumn had the best performance with an average value of 45.87% in Table 2. This is consistent with the results obtained by Thakur et al. (2016) reported the highest rooting (53.33%) was recorded in the cuttings with IBA at 5000 ppm found the best treatment for propagation of olive cuttings during winter period. This was similar to our study. In other study, Mohamed (2015) reported that the highest percentage of rooting in cuttings was observed in 4000 and 5000 ppm of IBA concentration in perlite medium.

Root lengths of cuttings taken from different local olive types and rooted in different periods are provided in Table 2. According to statistical analyses, effects of periods (P) were found to be significant ($P<0.05$), but the effects of Types (T) and Type x Period (T×P) interactions were not found to be significant ($P>0.05$). The greatest average root length (65.51 mm) was obtained from the cuttings rooted in autumn (Table 3). This is consistent with the results obtained by Thakur et al. (2016) reported the highest the maximum root length was determined with 5.30 cm. The same results were also determined in present research.

Table 2 The rooting ratio of the local olive types (%)

Type (T)	Rooting period (P)		Mean
	Spring (P1)	Autumn (P2)	
Type 1	29.97	52.00	40.99^{cd*}
Type 2	33.33	62.67	48.00^{bc}
Type 3	6.67	50.67	28.67^{c-g}
Type 4	6.67	30.67	18.67^{fg}
Type 5	28.00	45.33	36.67^{c-f}
Type 6	36.00	45.33	40.67^{cd}
Type 7	32.00	52.00	42.00^{cd}
Type 8	57.33	60.00	58.67^{b}
Type 9	20.00	20.00	20.00^{g}
Type 10	30.67	29.33	30.00^{d-g}
Type 11	22.67	57.33	40.00^{cde}
Type 12	14.67	37.33	26.00^{efg}
Type 13	22.67	25.33	24.00^{fg}
Type 14	36.00	30.67	33.34^{d-g}
Control	73.33	89.33	81.33^{a}
Mean	30.00^{b}	45.87^{a}	
LSD %5	T: 14.88 P: 5.43 T × P: ns**		

*: Different letters are statistically different in the columns (P<0.05), **ns: Not significant

Table 3 The average root length of the local olive types (mm)

Type (T)	Rooting period (P)		Mean
	Spring (P1)	Autumn (P2)	
Type 1	46.39	63.69	55.04
Type 2	61.21	65.09	63.15
Type 3	79.31	67.09	73.20
Type 4	28.09	58.30	43.20
Type 5	39.60	58.53	49.07
Type 6	53.63	56.76	55.20
Type 7	20.49	51.56	36.03
Type 8	31.80	57.60	44.70
Type 9	57.78	89.66	73.72
Type 10	56.32	70.22	63.27
Type 11	45.75	69.28	57.52
Type 12	26.25	78.43	52.34
Type 13	22.56	84.20	53.38
Type 14	62.06	67.28	64.67
Control	34.44	44.95	39.70
Average	44.38^{b*}	65.51^{a}	
LSD %5	T: ns** P: 8.52 T × P: ns		

*: Different letters are statistically different in the column (P<0.05), **ns: Not significant

Table 4 The average root number of the local olive types (unit)

Type (T)	Rooting period (P)		Mean
	Spring (P1)	Autumn (P2)	
Type 1	4.65	3.71^{de*}	4.18
Type 2	3.85	3.54^{de}	3.70
Type 3	1.25	4.11^{cde}	2.68
Type 4	2.00	2.84^{de}	2.42
Type 5	2.70	8.00^{b}	5.35
Type 6	3.47	3.54^{de}	3.51
Type 7	3.47	5.00^{cd}	4.24
Type 8	3.28	6.14^{bc}	4.71
Type 9	5.06	2.27^{d}	3.67
Type 10	6.70	3.65^{de}	5.18
Type 11	4.92	5.07^{cd}	5.00
Type 12	4.83	2.57^{d}	3.70
Type 13	5.36	3.64^{de}	4.50
Type 14	3.97	3.19^{de}	3.58
Control	14.47	17.08^{a}	15.78
Average	4.67	4.96	
LSD: %5	T: ns** P: 1.99 T × P: 2.81		

*: Different letters are statistically different in the column (P<0.05), **ns: Not significant

Table 5 The Shooting ratio of the local olive types (%)

Type (T)	Rooting period (P)		Mean
	Spring (P1)	Autumn (P2)	
Type 1	77.38	66.26^{abc*}	71.82
Type 2	80.00	58.26^{a-d}	69.13
Type 3	0.00	54.37^{a-d}	27.19
Type 4	8.33	30.20^{b-e}	19.27
Type 5	45.00	81.48^{a}	63.24
Type 6	14.36	55.00^{a-d}	34.68
Type 7	53.33	70.32^{ab}	61.83
Type 8	33.06	43.84^{b-e}	38.45
Type 9	36.51	6.67^{e}	21.59
Type 10	44.45	24.95^{e}	34.70
Type 11	45.72	54.16^{a-d}	49.94
Type 12	61.11	31.28^{de}	46.20
Type 13	68.15	17.04^{e}	42.60
Type 14	31.52	69.64^{abc}	50.58
Control	50.00	41.77^{cde}	45.89
Average	42.78	47.39	
LSD %5	T: 25.66 P: ns** T × P: 36.30		

*: Different letters are statistically different in the column (P<0.05), **ns: Not significant

Average numbers of roots are provided in Table 4. According to statistical analyses on number of roots, effects of Types (T) were not found to be significant (P>0.05), but the effects of Periods (P) and Type × Period (T×P) interactions were determined to be significant (P<0.05). As can be inferred from Table 4, the greatest number of roots was observed in the control group with 17.08 roots in autumn period, it was followed by T5 type rooted (8.00 roots) in autumn and the lowest number of roots (1.25 roots) was observed in T3 type rooted in spring period. Likewise, in a study conducted by Thakur et al. (2016) reported that the highest number of primary roots and secondary roots were found with 6.58, 8.53 respectively. The same results were also observed in present research. On the contrary, another research has reported that the highest number of roots were determined with 23.02 on rooting of semi-hardwood cuttings of Gemlik cultivar (Güler et al, 2017).

The shooting ratios of local olive types rooted in different periods are provided in Table 5. According to statistical analyses for shooting ratios, effects of periods were not found to be significant (P>0.05), but the effects of Types (T) and Type × Period (T×P) interactions were found to be significant (P<0.05). As can be seen in Table 5, the greatest shooting ratio (81.48%) was observed in T5 type rooted in autumn period, it was followed by T2 type rooted in spring period with 58.26% and the lowest shooting ratio was observed in T3 type rooted in spring period with 0%.

Conclusion

This study was primarily conducted to determine rooting ratios of drought-resistant (just to benefit from quite limited water resources of Northern Cyprus at upper most level), high yield and quality, well-adapted (to regional conditions) and economically valuable local olive types. Following the control group (Gemlik Olive), the greatest rooting ratio (58.67%) was obtained from Çamlıköy with Type 8 local olive type. Considering rooting periods and root lengths, the cuttings taken in autumn period exhibited the best performance. Again, following the Gemlik olive cultivar (control), the greatest number of roots (8 roots) was obtained from Cengizköy with Type 5 local olive type. In view of the number of roots of the cuttings in different periods, the cuttings taken in autumn period had better performance than the cuttings taken in spring period. The greatest shooting ratio (81.48%) was observed in Type 5 rooted in autumn period.

This study is the first scientific research on rooting performance of local olive types of Northern Cyprus. It was concluded based on present findings that the cuttings taken in autumn period should be used for cuttings-propagation of the local olive types.

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