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Evaluation of Different Olive Varieties for Yield Components and Oil Content

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Abstract: *In Pakistan, the annual demand for edible oils is approximately 4 million tons, whereas domestic production accounts for only around 1.4 million tons. The olive farming potential of Pakistan has been recognized due to more than 8 million wild olive plants and suitable land and climate conditions in various regions of KPK, Balochistan and Punjab. The current study was carried out to characterize the available olive cultivars for yield potential and oil profiling for improving local varieties. Analysis of variance (ANOVA) indicated significant variation among studied olive cultivars for all traits, including plant canopy, plant height, fruit length, fruit width, yield per tree, number of branches per plant, number of fruits drops per plant, flesh weight, and stone weight, whereas only stem girth was found non-significant among yield attributing traits. Similarly, oil profiling traits such as Oleic Acid (%), peroxide value and total phenolic content were also found significant at $p < 0.05$. This indicates that the studied olive cultivars have sufficient variability for improving the genetic makeup of olive in Balochistan. The mean value found maximum for plant height (inches) was registered by the Leccino (232.80), followed by Kala Mata (222.96), while the lowest plant height was measured for Arbosana (112.56). Maximum fruit length was measured in Kala Mata **(***2.64 cm***)** whereas lowest was measured for similar was followed closely by Arbosana(1.72 cm) they generally confirming dual use nature (yield+ oil) indicating more vigorous growth. The maximum yield (14.60 Kg) was registered by Kalamata followed by*

(9.30 Kg) by the Arbequina. This indicates that increase in yield was significantly higher due to collective function of number, size and weight of olives. Maximum Total Phenolic Content was recorded in Leccino (696.80 mg/kg) followed closely by Arbequina (611.60 mg/kg) as it is critical indicator of the antioxidant parameter in determining the quality and grade of olive oil.

***Keywords**: Balochistan, Evaluation, Olive varieties, Yield Components, Oil Content*

INTRODUCTION

Olive (*Olea europaea* L.) is one of the oldest cultivated tree species known for its adaptability to diverse environmental conditions, particularly its remarkable drought tolerance (Dehghan-Seresht *et al*., 2024).The olive tree is a diploid evergreen species that belongs in 2n = 46 to the family Oleaceae. The tree species is a small to medium sized tree. Furthermore, its height is 3 to 12meters with a gnarled trunk and dense crown. (Besnard *et al,* 2009). The leaves are simple and opposite, lanceolate and leathery with a silvery under surface. The leaf exhibits a well-thickened cuticle layer, along with a highly developed palisade mesophyll and a larger quantity of sclerenchymatous tissue, all of which serve to provide it with drought resistant properties. The flesh of the fruit is an oily drupe and is greenish yellow. It is a highly nutritious and delicious fruit (Boskou *et al*.,2015; Estruch *et al.,* 2013 and Poljuha *et al.*,2008).Virgin olive oil is obtained from the fruit of the olive tree solely through mechanical means and not through chemical means, has been noted for its quality. It is low-cost oil, it is relatively tasty and it does not spoil easily. Virgil olive oil is one of the thousands of types of olive oil that nature has offered mankind. It has a high content of monounsaturated fatty acids (MUFAs), chiefly oleic acid (55–83%), as well as polyunsaturated fatty acids (PUFAs), phytosterols, Tocopherols, and polyphenols. Olive oil extracted by the cold press method has extra ordinary quality features in the form of antioxidants and unsaturated fatty acids and hypoglycemic activity which are very useful in improving life quality, longevity and helpful against cardiovascular and cancer diseases (Leporini *et al.,* 2018; Perez-Jimenez *et al.,* 2007).

Olive cultivation is on the rise in Pakistan especially in Pothwar region Punjab. In the Brahui language, the substance is known as Khat, while the Pashto language refers to it using the term Showan, and in Urdu, the name Zaitoon is used Kahoo (Punjabi and Saraiki). The crop is drought tolerant and environmentally sustainable which makes it fit for the arid zones (Besnard *et al.,* 2009; Boulouha,B. (2010) L). Government programs like "Developing Pothwar into Olive Valley" and the PSDP initiatives have successfully planted over 2.9 million trees all over the country, with 1.77 million in Punjab alone. Pakistan imports 67% of the annual consumption of 2.9 million tons of edible oil. Therefore, olive cultivation can help reduce this dependency (Azmat *et al.,* 2020). Baluchistan's sub-mountainous terrain offers favorable conditions for olive (*Olea europaea* L.) cultivation, owing to its moderately cold winters, long sunshine hours, and well-drained soils (Pakistan Agricultural Research Council (PARC, 2020; Government of Pakistan GOP, 2021). Agro-climatic evaluations have identified key regions such as Loralai, Khuzdar, Zhob and Quetta as highly suitable for olive farming (Hussain *et al*., 2018; Ahmad *et al*., 2022). Several commercially important cultivars, including *Arbequina*, *Frantoio*, *Koroneiki*, *Gemlik*, and *Coratina*, have been introduced and tested under these regional conditions (PARC, 2020). Despite this suitability, major constraints-such as limited water availability, inadequate oil processing infrastructure, and weak market connectivity-continue to hinder sectoral growth (National Productivity Organization (NPO), 2021; Khan *et al*., 2020).

The success of olive cultivation depends significantly on the selection of well-adapted cultivars. Important agronomic traits under evaluation include canopy structure, stem girth, leaf area, flowering behavior and oil yield. In Pakistan, over 30 cultivars have been tested. Prominent among them are Gemlik (noted for high oil recovery), Arbequina (early bearing and compact) and Frantoio (adaptable and disease-resistant) contained the significant amount of olive oil (Long *et al.,* 2003). Comparative studies across environments have highlighted the need for localized research. For instance, Tunisian cultivars like Picholine and Fougi exhibit superior oil content compared to Dahbia and Lucques. The assessment of morphological and pomological characteristics is a crucial approach in evaluating the genetic diversity of olive germplasm and identifying promising cultivars for cultivation and breeding purposes. There is a lack of sufficient information regarding olive varieties of Balochistan which have high potential for yield and better oil content. Thus, current study helped in identification of high yielding and well-adapted Olive varieties for the agro-climatic conditions of Balochistan.

MATERIALS AND METHODS

A field experiment was conducted during the 2023 olive growing season at the experimental field of the Balochistan Agriculture Research and Development Center (BARDC), located in Quetta. The experimental material consists of four olive varieties which were obtained from the Balochistan Agriculture Research and Development Center (BARDC), located in Quetta. The study was designed to evaluate the performance of four olive varieties Kalamata, Leccino, Arbosana, and Arbequina under the agro-ecological conditions of Balochistan. The region has recently shown significant promise for olive cultivation due to its suitable climate and soil conditions. The present research was laid out in Randomized Complete Block Design (RCBD) with five of replications. The line spacing of olive cultivars was 6 by 6 feet. The data was recorded for various morphological traits, such as Plant Height (cm), Stem Girth (cm), Plant Canopy (m^3), Fruit Length (cm), Yield per Tree (kg), Oil Content (%), Free Acidity, Peroxide value (meq. O_2/kg) and Total Phenolic Content (mg/kg).The collected data was subjected to analysis of variance (ANOVA) to ascertain the significant differences among the tested varieties using computer software (Statistix-8.1) as suggested by Steel and Blaszczynski (1998). Further, treatment means were compared for Least Significant Differences (LSD) at 0.05 P-value and correlation coefficients for all studied traits were also computed as suggested by Gomez, K. A., & Gomez, A. A. (1984).

RESULTS AND DISCUSSION

The present study was conducted to find out the Evaluation of different olive Varieties for yield components and oil content was conducted under the agro-ecological conditions of Quetta, Balochistan, during the year, 2023. This study evaluated four olive varieties in a field experiment to evaluate the performance for yield and oil contents. The collected data was analyzed for analysis of variance (ANOVA) to determine the variation levels among the studied olive varieties. Additionally, principal component analysis and

correlation analysis for all examined traits were computed to understand the interrelationship between the varieties and identification of most diverse varieties.

PLANTVEGETATIVE RESPONSE OF DIFFERENT OLIVE VARITIES

Plant Height (cm)

Plant height plays a common role for Olive as it increases photosynthetic area for leaves which results in more economic yield. Evaluation of different olive Varieties for yield components and oil content resulted in significant difference in plant height (Table 4.1 & Table 4.2). The highest plant height was noted in Leccino (**232.80 inches**) followed by Kalamata which was (**222.96 inches**), while the lowest plant height was noted in Arbosana that was (**112.56 inches**). The rest of the treatments showed various degree of effect on plant height. This data revealed that Leccino has the great potential to remain tallest growth compared to other treatments. The results suggest that Leccino has potential to increase plant height; these are in consonance to the finding of Fabrri *et al*. (2004) along with Fernández-Escobar *et al*. (2013) that Olive oil quality and cultivar influence with Olive Propagation. Similar results for plant height are quite in line with those of Boulouha, (2010) and International Olive Council, (2013) that Olive growing in rainfed and irrigated areas effects due to climate on verities of Olive. Furthermore, these results come from poor post-harvest handling or storage conditions and negatively impacts both oxidative stability and sensory characteristics of the oil and yield.

Stem Girth (cm)

Stem Girth are also very important factor for Olive as more number of stems carry more leaves that subsequently leads to more photosynthesis, more plant growth and more yield. Evaluation of different olive Varieties for yield components and oil content resulted in significant difference in Stem Girth (Table 4.1 & 4.2). The highest and thickest stem was observed in Leccino (3.93 cm), similar was followed by Arbequina (3.93 cm) suggesting good stem robustness which supports higher yields over time while the lowest Stem Girth was noted in Kalamata that was (**1.93 cm**). The rest of the treatments showed various degree of effect on Stem Girth. This data revealed Leccino has the great potential to remain thickest. The results suggest that Leccino has potential to promote growth; these are in consonance to the finding of the results underscore the superior vegetative potential of Leccino, which is consistent with earlier findings by Bartolini & Petruccelli (2002) that classification, origin, diffusion and genetic improvement of olive. Similar results for stem girth are quite in line with those of Connor*et al*, (2014) and Gucci *et al*, (2007) that Olive orchard management: Advances and future prospects depend on water deficit-induced changes in mesocarp cellular processes and oil content in olive fruits.

Plant Canopy (ft)

Plant canopy also play important role for Olive trees. Evaluation of different olive Varieties for yield components and oil content resulted in significant difference in plant canopy (Table 4.1 & 4.2). The highest plant canopy was observed in Leccino (19.40 ft) similar was followed closely by Kalamata (18.58 ft) they are generally having broader canopies, indicating more vigorous lateral growth in both above mentioned treatments which can influence light interception and productivity while the lowest plant canopy was noted in Arbequina that was (12.74 ft). The rest of the treatments showed various degree of effect on plant canopy. This data revealed Leccino has the great potential to remain broader and thickest; these are in consonance

to the finding of the results underscore the superior vegetative potential of Leccino, which is consistent with earlier findings by Rapoport & López-Bernal, (2014) that temporal dynamics of olive tree canopy and yield responses depends upon pruning practices. Similar results for plant canopy are quite in line with those of Connor *et al*, (2014) and Gucci *et al*, (2007) that Olive orchard management: Advances and future prospects depend on water deficit-induced changes in mesocarp cellular processes and oil content in olive fruits.

Stem Girth Measurement

FRUIT MORPHOLOGY RESPONSE OF DIFFERENT OLIVE VARITIES

Fruit Length (cm)

Fruit Length also play important rolefor Olive trees.Evaluation of different olive Varieties for yield components and oil content resulted in significant difference in fruit length (Table 4.1 & 4.2). The highest fruit length was observed in Kalamata (2.64 cm) similar was followed closely by Arbosana(1.72 cm) they are generally confirming dual use nature (yield+ oil), indicating more vigorous growth in both above mentioned treatments while the lowest fruit length was noted in Arbequina that was(1.39 cm)which was reflecting its specialization in oil production. The rest of the treatments showed various degree of effect on fruit length. This data revealed that Kalamata has the great potential to produce larger fruits, Similar observations on the correlation between fruit length, fruit size, cultivar type and use have been reported by Tous and Romero (1993) along with Dag *et al*, (2011) who emphasized the importance of selecting cultivars based on targeted end-uses (oil vs table olives).

Cutting of Olive Fruit for Stone and Flesh Weight

Fruit Width

Fruit Width also play important rolefor Olive trees.Evaluation of different olive Varieties for yield components and oil content resulted in significant difference in fruit width (Table 4.1 & 4.2). The highest fruit width was observed in Kalamata (1.64 cm) similar was followed closely by Leccino(1.28 cm) they are generally indicating more vigorous growth in both above mentioned treatments while the lowest fruit width was noted in Arbequina that was(1.19 cm)which was reflecting its specialization in oil production**.** The rest of the treatments showed various degree of effect on fruit length. This data revealed that Kalamata has the great potential to produce larger fruits. These are in consonance to the finding of Ferguson*et al,* (2010) and Lavee & Wodner (2004) who reported the effect of different irrigation regimes on growth and yield of olive trees with Olive production. Similar observations on the correlation between fruit length, fruit size, fruit width, cultivar type and use have been reported by Tous and Romero (1993) along with Dag *et al,* (2011) who emphasized the importance of selecting cultivars based on targeted end-uses.

FRUITING CHARACTERISTICS AND YIELD RESPONSE OF DIFFERENT OLIVE VARITIES

Number of Branches

Number of Branches also play very important factor for Olive as more number of branches carry more stems & leaves that subsequently leads to more photosynthesis, more plant growth and more yield.

Evaluation of different olive Varieties for yield components and oil content resulted in significant difference in number of branches (Table 4.1 & 4.2). The highest and more branches were observed in Kalamata (13.40), similar was followed by Leccino (6.60) suggesting good contribution to its fruit-bearing potential despite moderate individual fruit size while the lowest number of branches were noted in Arbosana that was (5.00). The rest of the treatments showed various degree of effect on number of branches. This data revealed Kalamata contributed to its fruit-bearing potential despite moderate individual fruit size. These are in consonance to the finding of Rapoport and López-Bernal (2014) who highlighted the importance of branching patterns in maximizing light interception and optimizing reproductive potential in olive orchards. Similar results for number of branches are quite in line with those ofConnor*et al*, (2014) and Gucci & Fereres, (2012) that Olive orchard management: Advances and future prospects depend on water deficit-induced changes in mesocarp cellular processes and oil content in olive fruits.

Number of Fruit Drop

Fruit Drop also play important rolefor Olive trees.Evaluation of different olive Varieties for yield components and oil content resulted in significant difference in fruit drop (Table 4.1 & 4.2). The highest fruit drop was observed in Kalamata (27.00) similar was followed closely by Arbequina(15.40)while the lowest fruit drop was noted in Arbosana that was(11.60). The rest of the treatments showed various degree of effect on fruit drop. This data revealed that Kalamata has the great potential to produce larger fruit drops. Similar insights have been reported by Lavee *et al.* (1984) and Hartmann *et al.* (2011), who noted that olive cultivars respond differently to environmental stressors and that improved nutrition and irrigation strategies can significantly reduce preharvest fruit drop. Similar results for fruit drop are quite in line with those of Gucci & Fereres, (2012) along with Fereres& Soriano (2007) that Olive orchard management: Advances and future prospects depend on water deficit-induced changes in mesocarp cellular processes and oil content in olive fruits. Furthermore, Fruit drop in olives is a cultivar-specific physiological response that influences marketable yield and must be managed through nutritional and water optimization strategies.

Flesh Weight (g)

Flesh Weight also play important role for Olive trees. Evaluation of different olive Varieties for yield components and oil content resulted in significant difference in flesh weight (Table 4.1 & 4.2). The highest flesh weight was observed in Kalamata (19.48 g) similar was followed closely by Leccino(17.98 g) while the lowest flesh weight was noted in Arbosana that was(16.90).The rest of the treatments showed various degree of effect on flesh weight. This data revealed that Kalamata has the great potential to produce larger flesh weight. These are in consonance to the findings that have been reported by Dag *et al*,(2011) and Lavee & Wodner (2004) highlighted the influence of cultivar genetics and nutrient management on olive fruit morphology and quality. Similar results for flesh weight are quite in line with those ofRapoport and López-Bernal (2014).

Stone Weight (g)

Stone Weight is an important yield component in olive cultivation, as it contributes to the overall fruit structure and influences oil extraction efficiency. Evaluation of different olive Varieties for yield components and oil contents revealed a statistically significant difference in stone weight among the tested varieties (Table 4.1 & 4.2). The highest stone weight was recorded in Kalamata (9.77 g), followed closely by Arbequina (8.63 g), while the lowest was observed in Leccino (8.23 g). The remaining cultivars exhibited

intermediate values, indicating a varietal effect on stone development. These results suggest that Kalamata has strong potential to produce fruits with a high stone-to-flesh ratio. These are in consonance to the finding of Bartolini *et al*. (1998) emphasized that stone dimensions, when correlated with fruit weight can serve as indirect indicators of ripening stage, cultivar identity and oil-to-fruit ratio. Such differences in stone weight also reflect adaptation mechanisms as cultivars with higher stone biomass may be better suited for drier environments, aiding seed protection and reproductive success.

Data Recording for Olive Stone Weight (g)

Yield per Tree (Kg)

Yield is a key parameter in olive cultivation, as it is a composite function of fruit number, size, and weight. An evaluation of different olive cultivars for yield components and oil content revealed statistically significant differences in yield per tree among the tested varieties (Table 4.1 & 4.2). The highest yield was recorded in Kalamata(14.60Kg), followed closely by Arbequina (9.30Kg), while the lowest yield was observed in Leccino (2.60Kg).The other varieties were raised intermediate values, which indicate the varietal effect. Our findings indicate that the Kalamata variety has strong potential to produce fruit with high stone-to-flesh ratio which may positively influence yield and oil extraction efficiency. These results are in line with the findings of Taticchi *et al.* (2017), Rodríguez *et al.* (2020) and Gómez and Ortega (2018) on the variability of stone weight and its impact on oil yield and a comprehensive study on the genetic

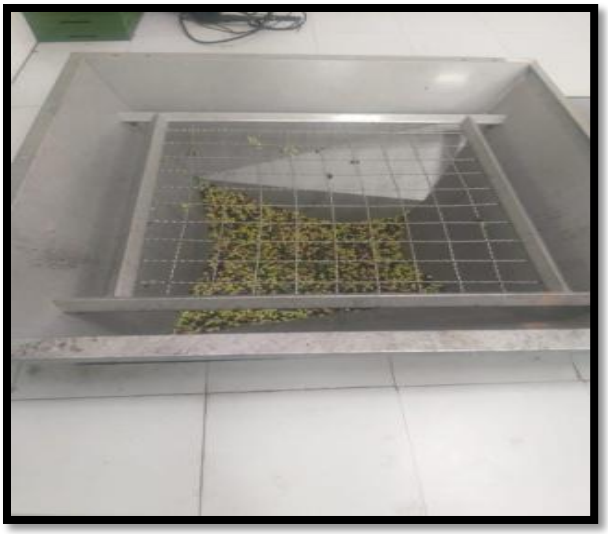
diversity of olive cultivars, with particular focus on yield and stone weight as key agronomic traits across different varieties.

Data Collection for Olive Oil Extraction (g)

OIL QUALITY PARAMETERSRESPONSE OF DIFFERENT OLIVE VARITIES

Free Acidity (Oleic Acid %)

The determination of the quality and grade of olive oil is based on the free acidity of the oil. Evaluation of different olive varieties for yield components and oil content showed statistically significant differences in free acidity in the study varieties. (Table 4.1 & 4.2). The highest free acidity was recorded in Kalamata (0.23 %), followed closely by Arbequina (0.21 %), while the lowest yield was observed in Leccino (0.14 %). It is typically expressed as a percentage of oleic acid, which is the predominant monounsaturated fatty acid in olive oil. Free acidity reflects the extent of hydrolytic degradation of triglycerides into free fatty acids and is directly influenced by factors such as fruit ripeness at harvest, processing delays, mechanical damage, and microbial activity. Lower values of free acidity are indicative of better oil quality. According to the International Olive Council (IOC) standards, extra olive oil must have a free acidity of less than or equal to 0.8%, while olive oil may contain up to 2.0%. Elevated free acidity generally results from poor post-harvest handling or storage conditions and negatively impacts both oxidative stability and sensory characteristics of the oil. The remaining cultivars exhibited intermediate values, indicating a varietal effect on yield. These are in consonance to the finding of Boskou, (2006), Servili *et al.* (2004) and Aparicio& Harwood, (2013) Health and sensory properties of virgin olive oil hydrophilic phenols: Agronomic and technological aspects of production that affect their occurrence in the oil.



Free Acidity (Oleic Acid %)
Peroxide Value (meq. O_2/kg)

The peroxide value (PV) is one of the most important indicators of the oxidative stability and freshness of oils and fats, including olive oil. Evaluation of different olive cultivars for yield components and oil content revealed statistically significant differences in free acidity among the tested varieties (Table 4.1 & 4.2). The highest free acidity was recorded in Kalamata (12.40 meq. O_2/kg), followed closely by Leccino (11.44 meq. O_2/kg), while the lowest yield was observed in Arbosana (9.48 meq. O_2/kg).According to the International Olive Council (IOC) and Codex Alimentarius, the maximum acceptable peroxide value for extra virgin olive oil is ≤ 20 meq O_2/kg. Exceeding this threshold indicates deterioration due to improper handling, prolonged storage, or exposure to air, heat, or light.These results are in line with the findings ofShahidi & Zhong, (2005) who found similar favourable results for per oxide value which is theimportant indicators of the oxidative stability and freshness of oils and fats, including olive oil. Similar findings were found by Boskou, (2006) and Codex Alimentarius, (2019) as well.

Peroxide Value (meq. O_2/kg)

Total Phenolic Content (mg/kg)

Total Phenolic Content is also key&critical indicator of the antioxidant parameter in determining the quality and grade of olive oil. Evaluation of different olive cultivars for yield components and oil content revealed statistically significant differences in free acidity among the tested varieties (Table 4.1 & 4.2). The highest Phenolic Content was recorded in Leccino (696.80 mg/kg), followed closely by Arbequina (611.60 mg/kg), while the lowest Phenolic Content was observed in Kalamata (593 mg/kg).According to the International Olive Council (IOC) and related scientific literature, Phenolic Content is directly associated with oil stability, oxidation resistance, and positive sensory attributes, including bitterness and pungency. As such, TPC is routinely used as a benchmark for evaluating olive oil quality; especially in high-value extra virgin products.These results get support from the findings of Servili *et al*. (2009) who found Phenolic compounds in olive oil: Antioxidant, health and organoleptic activities according to their chemical structure. Similar results were found by the Boskou, (2006), Owen *et al*. (2000) along with Brenes & Garcia (2010).



Total Phenolic Content (mg/kg)

The mean variancesconcerning toOlive Varities morphological attributes indicted the highly significant differences (*P > 0.01*) for Plant Height (cm),Plant Canopy (m^3), Fruit Length (cm), Yield per Tree (Kg) and oil content(Table 4.1& 4.2). However, significant differences(*P > 0.05*) among tested cultivar were observed for Plant Height (cm), Plant Canopy (m^3), Fruit Length (cm), Fruit Width (cm),Yield per Tree (Kg), Number of branches, Stone Weight (g) and oil content. This indicates that studied set of olive cultivars exhibited a considerable variation which could be utilized in olive breeding and yield improvement programs.Furthermore, coefficient of variation (CV%) was found to be greater for yield per tree (Kg) (14.60 Kg), indicating vast range of variability in studied varieties. Previously, some similar types of studies were conducted by various researchers on olive cultivarson the variability of stone weight and its impact on oil & yield and a comprehensive study on the genetic diversity of olive cultivars, with particular focus on yield and stone weight as key agronomic traits across different varieties (Taticchi *et al.* 2017, Rodríguez *et al.* 2020 and Gómez and Ortega, 2018).

Table 4.1: Evaluation of Different Olive Varieties for Yield Components and Oil Content

Parameters	Arbosana (T1)	Arbequina (T2)	Leccino (T3)	Kalamata (T4)
Plant Height (cm)	112.56 c	152.88 b	232.80 a	222.96 a
Stem Girth (cm)	28.00	31.00	37.00	35.00
Plant Canopy (ft)	16.00 a	12.74 c	19.40 b	18.58 ab
Fruit Length (cm)	1.72 b	1.39 c	1.48 c	2.64 a
Fruit Width (cm)	1.24 b	1.19 b	1.28 b	1.64 a
Yield per Tree (kg)	5.14 c	9.30 b	2.60 d	14.60 a
No. of Branches	5.00 b	5.40 b	6.60 b	13.40 a
Fruit Drop (%)	11.60 b	15.40 b	14.80 b	27.00 a
Flesh Weight (g)	16.90 b	17.20 b	17.98 b	19.48 a
Stone Weight (g)	8.35 b	8.63 ab	8.23 b	9.77 a
Oleic Acid (%)	0.20 a	0.23 a	0.14 b	0.22 a
Peroxide Value (meq O2/kg)	9.48 c	9.60 c	11.44 b	12.40 a
Total Phenolic Content (mg/kg)	594.60 c	611.60 b	696.80 a	593.00 c
LSD (p<0.05)	2.8573	34.740	0.2285	0.2120

T_1= Arbosana, T_2= Arbequina, T_3= Leccino, T_4= Kalamata

Table 4.2: Evaluation of Different Olive Varieties for Yield Components and Oil Content

Cultivars	PCF	SG	PHI	FLC	FW	YPT (Kg)	NOB	FD	FWG	SWG	OA	PV	TPC
Kala Mata (T4)	18.58	1.93	222.96	2.64	1.64	14.600	13.40	27.000	19.48	9.77	0.22	12.40	593.00
	AB	B	A	A	A	A	A	A	A	A	A	A	C
Leccino (T3)	19.40	3.93	232.80	1.48	1.28	2.60	6.600	14.800	17.98	8.23	0.14	11.44	696.80
	B	A	A	C	B	D	B	B	B	B	B	B	A
Arbequina (T2)	12.74	3.93	152.88	1.39	1.19	9.30	5.400	15.400	17.20	8.63	0.23	9.60	611.60
	C	A	B	C	B	B	B	B	B	AB	A	C	B
Arbosana (T1)	16.00	2.93	112.56	1.72	1.2400	5.14	5.000	11.600	16.90	8.35	0.20	9.48	594.60
	A	AB	C	B	B	C	B	B	B	B	A	C	C
Average	16.68	35.4	100.86	1.8085	1.8085	1.3375	7.475	8.05	19.45	17.8952	8.7464	0.1995	10.68
LSD *	2.8573	N.G	34.740	0.2285	0.2120	1.9685	1.8994	6.9301	1.1104	1.2564	0.0282	0.3497	14.625
CV (%)	12.43	10.94	13.98	9.17	11.50	18.06	18.14	29.24	4.50	10.42	10.26	2.38	1.70

Conclusion

Kalamata excels in **yield, fruit size** and canopy which is ideal for **dual-purpose cultivation** but it requires **much care in oil storage** due to higher peroxide values. It is compact, productive and has **high-quality oil** it is ideal for **dense plantations and commercial oil** production.

Recommendation

It is recommended that such trail should be conducted in multi-locations, multi-season trials to confirm better performances across the diverse environmental conditions.

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