INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 20, No. 5, p. 78-86, 2022

RESEARCH PAPER OPEN ACCESS

Comparative study of different exotic olive varieties under the climatic condition of Quetta, Balochistan

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Key words: Olive, climate, nutrients, oil.

http://dx.doi.org/10.12692/ijb/20.5.78-86 Article published on May 24, 2022

Abstract

The present study was conducted under arid sub-tropical conditions of Quetta Balochistan to evaluate the impact of climatic variations on five olive cultivars, i.e., (Kalamata, Leccino, Pandolino, Arbosona and Arbiquina) through the selection of suitable gene types based on fruit production and oil production. The data recorded for different olive cultivars revealed that the highest oil production percentage was observed in olive cultivars Kalamata 21%, Leccino 20%, and Arbiquina 17%. The lowest oil production percentage was detected in the cultivars Pandolino 16% and Arbosona 10%. Tree canopy, the staminate height of trees and final fruit set percentage and yield per plant reported extremely significant differences among different cultivars. However, fruit size (Length and width), canopy and height of trees and 100 fruit weight of each plant showed less variation among the cultivars. Oil extraction percentage and total fruit weight per plant showed extreme variability among all the characters. Concluding, olive cultivars, i.e., Kalamata, Leccino and Arbiquina found most suitable for oil extraction under the climatic condition of Quetta, Balochistan, Pakistan.

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Introduction

Olea europaea (L.), known as olive, which means "European olive" is a species of small tree belonging to the Oleaceae family, traditionally found in the Mediterranean basin. This variety is grown in all Mediterranean countries as well as in Australia, New Zealand, North, South America, South Africa and Pakistan (Rizwan *et al.,* 2019). The *Olea europaea* L. has been cultivated for its beneficial and widely used oil, fine wood, leaf and fruit. Olive is examined as the major tree fruit yield in the world, particularly in Mediterranean countries but also in Asia and especially in Pakistan due to the production of oil. However, because of its nutritional value, it is considered to be a tree of blessing and healing in the Qur'an, Chapter 24 Al-Noor, Article 35 (Rizwan *et al.,* 2019). Olive oil and table olives are the main ingredients in Quetta, Pakistan and are used all over the world. Extra virgin olive oil is preferred over vegetable oil because of its exclusive and well-adjusted amount of monounsaturated and polyunsaturated fatty acids that reduce the risk of heart diseases and help to control blood cholesterol levels (Rizwan *et al.,* 2019). Other minor ingredients in extra virgin olive oil are minerals and phenolic compounds that have antioxidant and antimicrobial effects that help to prevent cancer. Annually around 90 to 92% of olive fruits are used for oil production (Rizwan *et al.,* 2019). Olive trees consume a very low amount of water. It is very much suitable for those countries which are facing water scarcity, especially Pakistan. Nowadays, the people of Pakistan's province Balochistan are aware of the beneficial role of olives; therefore, cultivating olive trees because of their potential to consume the minimum amount of water. It is used for skin care, heart diseases, cancer, body pain release, etc. The use of olive oil is popular in Pakistan. Olive oil may have antifungal activity, especially hydroxytyrosol, an antioxidant found in olive oil (Karagounis *et al.,* 2019). Olive oil has been used in large quantities, which has led to the high value of dietary lipids as the percentage of total calories in the country is 37 to 45 percent or more (Keys, 1995). Europe has planted in the unique territory of Pakistan.

The main aim of this study is the cultivation of new olive farms in Balochistan and other affected areas FATA and the Patohar region. In Balochistan, olive trees are cultivated in Quetta, Zhob, Loralai, Bagbana and Wadh regions are measured which have been considered very appropriate for olive cultivation (Rizwan *et al.,* 2019). The displayed aroma, vitality and color of virgin olive oil differentiate it from all lovely vegetable oil. Organoleptic products and attractive vitamins, along with existing customers choosing the least processed foods, have an impact on their appearance in regulated markets (Bilancia *et al.,* 2005). Olive oil, mauve, vegetables and fruitlets from roots, fish, meat (in minor magnitudes), produces milk (fruits and cheeses) and nuts. Olive oil is enriched in monounsaturated fatty acids (including 55 to 85% of saturated fatty acids) as well as antioxidants like vitamin E and a combination of miracles (Visioli & Galli, 2001).

The genetic source of olive oil is Olive *Olea europea* L. var. communism is unknown. Some scientists believe that the "European" olives, which have the only Ole with a lot of fruit, can be consumed in two or more two varieties (Vossen 2007). At each location where the olive grows there is an olive tree and grass called oleaster or acebuche. These plants can be domesticated with birds and grow animals with other fruits, or they can be adapted to categories or ecotypes that existed before the appearance of the cultivated olive. (Lavee, 1996) Olive oil is a form of fat that can be absorbed by permanent olive oil. The use of olive oil for skin care goes back to ancient Egypt. The authors proposed an additional advantage of olive oil over the failure of a 4-point scale on skin characteristics (Karagounis *et al.,* 2019). Determination of fatty acids - high oleic acid (55-88%) and low-slung PUFA (2-21%), and the occurrence of extremely antidepressant polyphenols (124- 516 mg kg1 formulated as tyro sol equiv.), especially hydroxyl tyro sol product in 80 mg kg1 reported is like salt (Cheikhousman *et al.,* 2005). Numerous studies have been conducted to control the stimulation, irrigation, reduction, oil extraction and packing of virgin olive oil. However, despite the

biological effects of olive oil polyphenol, there is very little data available on polyphenol content with the benefit of olive oil (Garcia *et al.,* 2003). This research aims at determining the olive oil percentage in five different exotic varieties along with its different other growth attributes in the Quetta region.

Materials and methods

Plant selection and sample collection

Plant material, i.e., five olive cultivars (i.e., Arbosana, Lecino, Arbiquina, pandolino and Kalamata) were collected from Balochistan Agriculture Research and Development Center, Quetta, by random sampling technique. These olive trees were planted in March 2013 for obtaining the olive oil percentage from fruits; the samples were harvested in November 2020 by hand and twenty plants from each variety were selected. Total harvested fruits of each plant species were weighted by a digital weight machine for analysis and oil extraction. Then three fruits of each tree were taken for analyzing their length and width with a measuring tool. Therefore, a total of 300 fruits were used for analyzing fruit size. The harvested fruits were then stored in plastic boxes, which were then kept in cool storage till oil extraction, where the temperature was 10-15° C and at a low relative humidity of 50-60% (Rizwan *et al.,* 2019).

Oil extraction

The olive cultivars were separated, sprayed and washed with water for oil extraction and the fruits were crushed to form a paste. Traditionally, this was done with stone crushers, but modern machines such as hammer mills and grinders have replaced stone. After crashing the paste through Mallick's action phase, which basically stirred the mixture in preparation for extracting the liquid at this point. The solids and liquids, including both water and oil, were separated from the paste. From the 17th century till date extracting the liquids was accomplished with an olive press that would squeeze the paste on baskets or mats to press out the liquid. Today millers rely on advanced decanting and centrifugation machines which help gravity work more quickly by spinning the mixture to generate the separation after the initial liquids (Rizwan *et al.,* 2019).

Weight of 100 fruits

The 100 harvested fruits of each cultivar were weighted by a digital weight machine after harvest.

Canopy and height

The fiber measuring tape was used to measure the average canopy diameter of a tree. First, the width from one end to the other end of the olive tree was measured by measuring tape then the width was measured for the longest axis of the canopy. Further, once the distance was determined, then it was turned on 90 degrees and again distance was taken out.

After that, both determined distances were summed up and the total was divided by 2 to get the canopy average. The first long axis measured 7.3 feet and then the 90 axis measured 7.1 feet and so to get the average canopy diameter. In order to ensure the accuracy and validity of data, two tools were simultaneously used for measuring the plant height such as measuring tape and a stick. The trees that were between the height of 7 to 8 feet were measured using a measuring tape, whereas, for trees that were beyond 7 to 8 feet, the stick was used to collect data regarding the exact size of the sampled/targeted trees (Brenes *et al.,* 2017; Iqbal. *et al.,*2019)

Fruit Length and Width

The three harvested fruits of each cultivar were taken for analyzing their length and width with a measuring tool. Therefore, a total of 300 fruits' length and width were analyzed after harvest.

Total weight per plant

After harvest, the total harvested fruits of each olive variety were weighted by a digital weight machine to get each tree's olive production per kg.

Statistical analyses

Results

Canopy and height

The data record for canopy and height of different

olive varieties statistically showed significant results. Results revealed that the olive variety Leccino showed the maximum height with the best canopy as well, while the minimum height and canopy were recorded in the Arbosona variety of olive. The trend observed for varieties canopy and height observed as follows: Leccino> Kalamata>Pandolino>Arbiquina> Arbosona. Considering the overall results of olive varieties, it has been observed that Leccino variety had a better canopy than the tallest plants (Fig. 1).

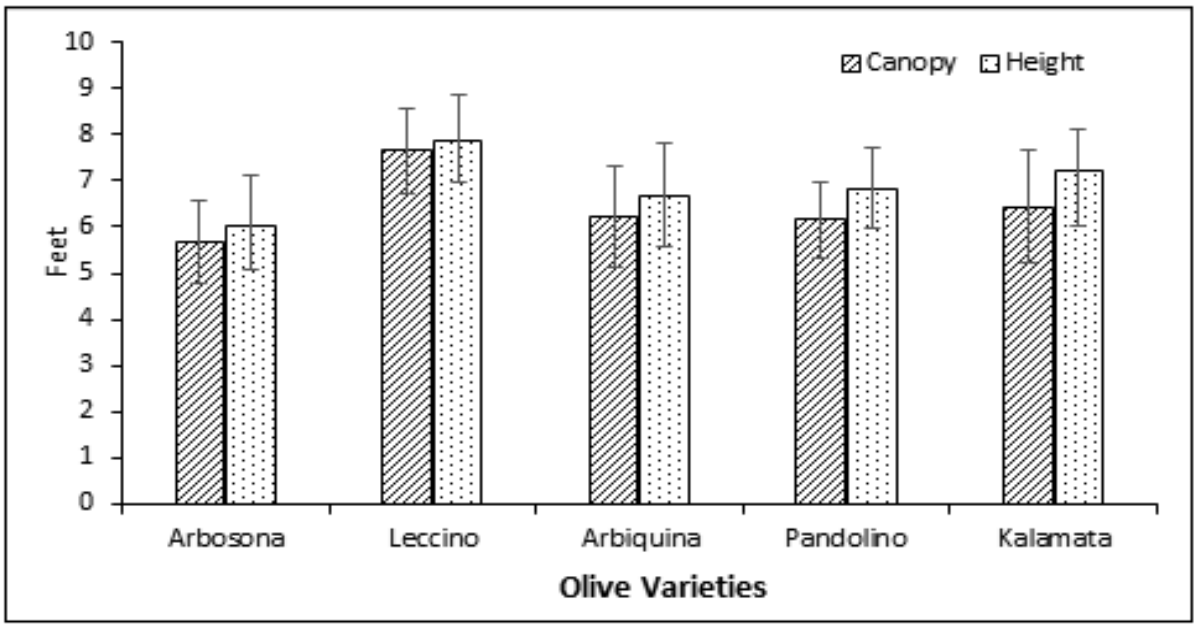

Fig. 1. Canopy and height of five varieties of olive grown at Quetta, Balochistan.

Total weight per plant

Results obtained for total weight per plant of *Olea europea* L. showed significant results. Data further revealed that the total Weight of Arbosona variety showed the highest and the lowest weight of the plant was observed in the Leccino variety. The order of changes in different olive varieties was observed as Arbosona >Pandolino>Kalamata>Arbiquina> Leccino. In a nutshell, it has been revealed from the results that the olive variety Arbosona had the highest weight, which illustrated that the olive cultivar effectively grew as a healthy plant (Fig. 2).

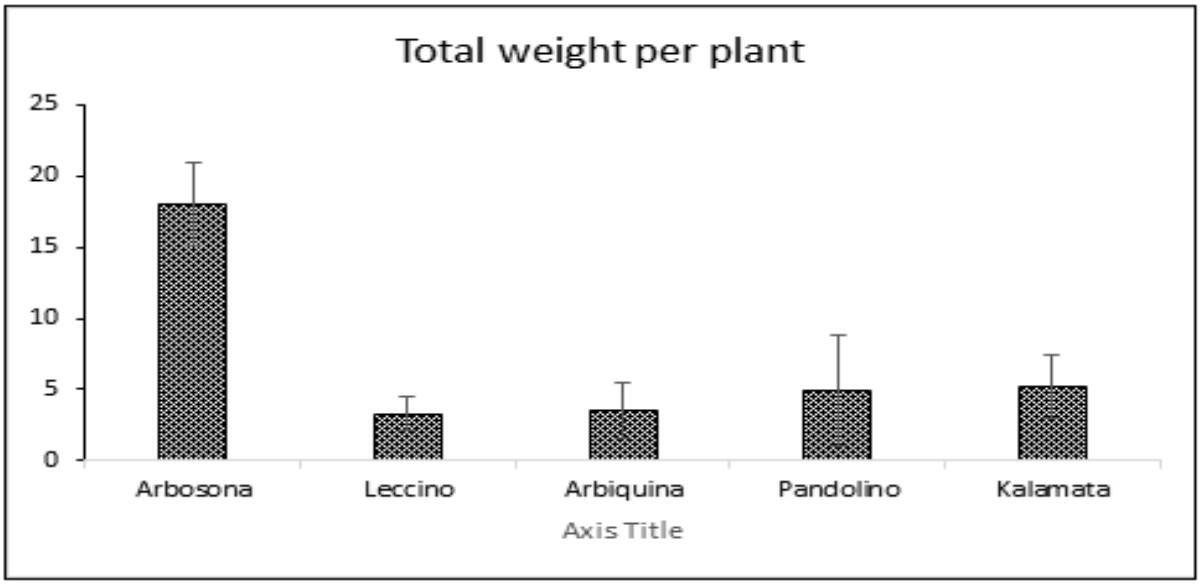

Fig. 2. Total weight per plant of five varieties of olive grown at Quetta, Balochistan.

100 fruit weight per plant

Data reported for olive varieties of 100 fruits weight showed statistically significant results. Results revealed that the maximum weight of fruit was observed in Kalamata variety while the minimum fruit weight was recorded in Arbosona olive variety. The trend of 100 fruit weight was as: Kalamata>Leccino>Pandolino>Arbiquina>Arbosona. Overall results revealed that olive varieties showed the best weight of 100 fruits, but however, Kalamata variety proved to have the largest fruit weight among 100 fruits which illustrate its fruit quality (Fig. 3).

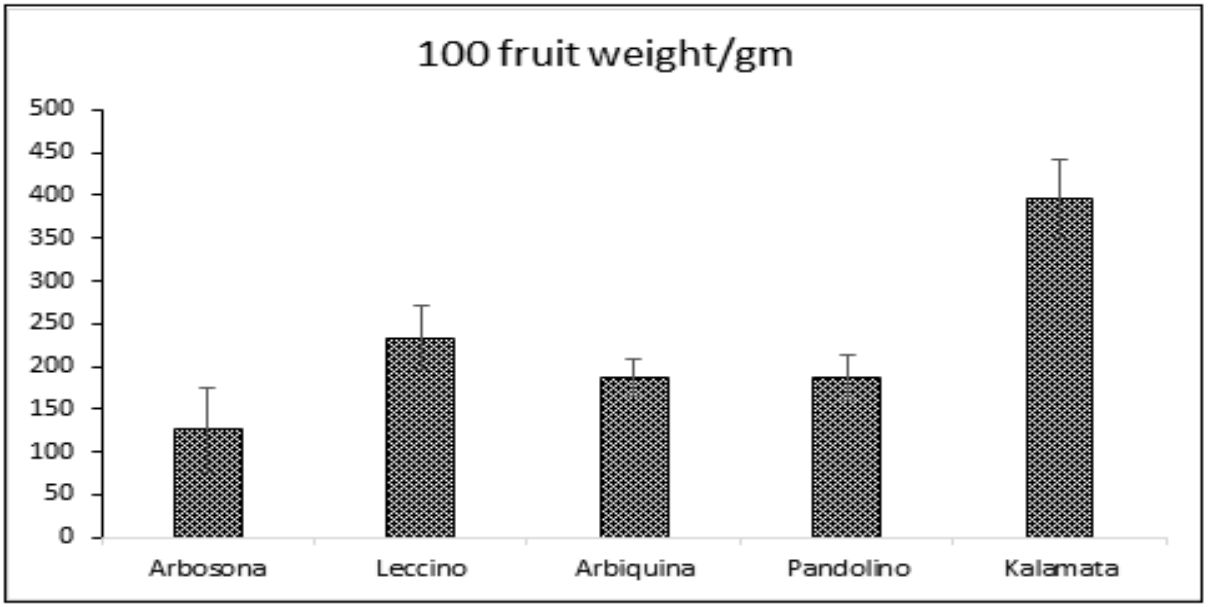

Fig. 3. 100 fruit weight of five varieties of olive grown at Quetta, Balochistan.

Fruit length and width (fruit size)

Data obtained for fruit length and width of five olive various showed statistically significant results. Overall data revealed that the fruit length of Kalamata variety was the highest with the lowest width, while the minimum fruit length was recorded in Pandolino variety with a bit high width. Considering overall results, it has been well established that olive fruit showed varietal differences, thus producing fruits with varying fruit sizes (Fig. 4).

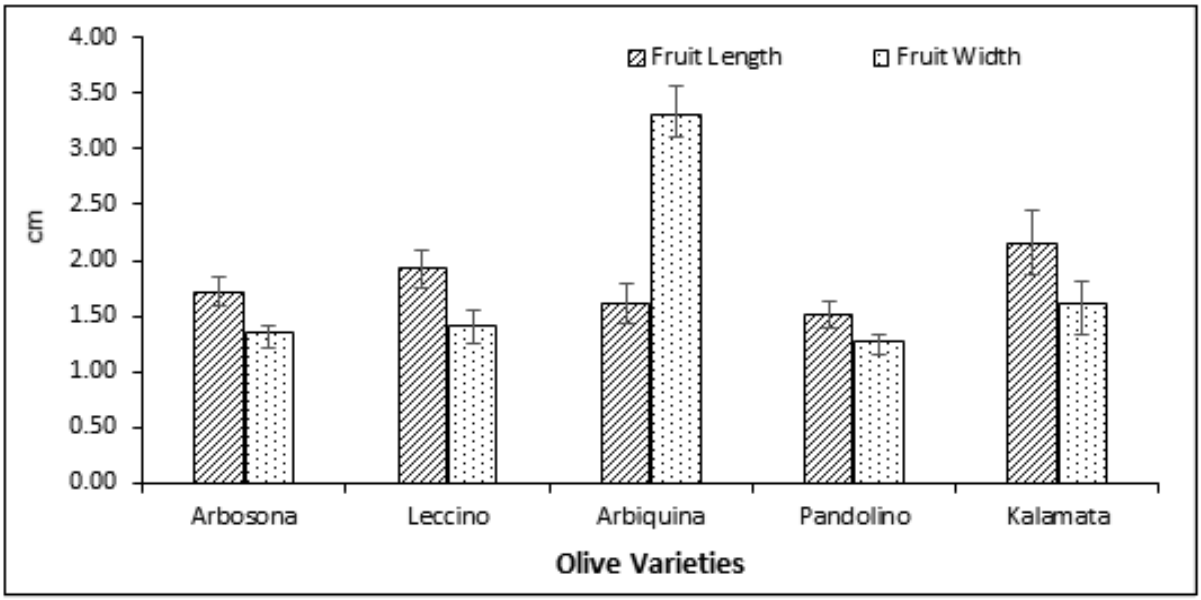

Fig. 4. Fruit length and width of five varieties of olive grown at Quetta, Balochistan.

Oil extraction

Results obtained for a total percentage of oil extraction per variety of trees of *Olea europea* L. showed significant results. Data further revealed that the total percentage of oil extraction in Kalamata variety showed the highest and the lowest percentage was observed in Arbosona variety. The order of changes in different olive varieties was observed as Kalamata>Leccino>Arbiquina>Pandolino>Arbosona. In a nutshell, Kalamata variety having the highest oil percentage illustrate that this olive variety can be recommended for oil (Fig. 5).

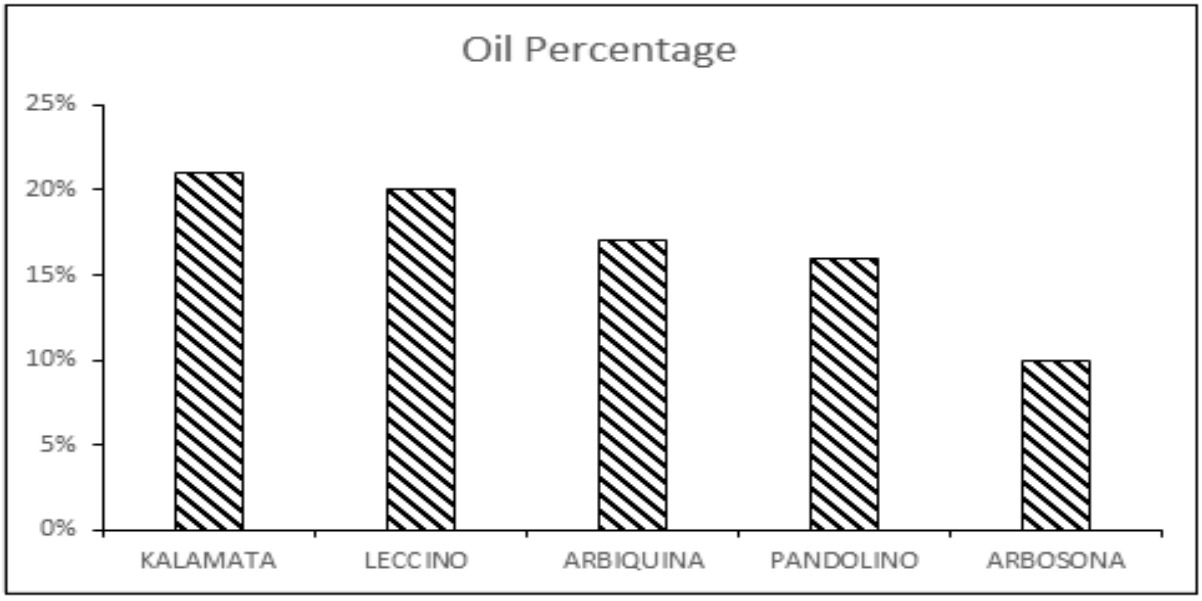

Fig. 5. Oil percentage of five varieties of olive grown at Quetta, Balochistan.

Discussion

Data for height and canopy of olive varieties showed that Leccino was the tallest and had the largest canopy. The 'Coratina' was the smallest and the 'Moraviolo' had the smallest canopy than cultivars planted later. Not astonishingly, that the plants planted earlier were taller and had more canopies than those planted later. Our results portray a different side by showing that the height and canopy of olive varieties such as 'Leccino' showed the tallest with the best canopy as well among the other varieties' Arbosona' the smallest. Not surprisingly, considering the overall results of olive cultivars canopy and height, it has been observed that Leccino cultivar may be conducting proper water than other varieties (Fig. 1). The Arbequina variety seems to be the classically used variety for many years, especially in condensed systems. There are several clones of this type, one of which is the 1-18, which came first in some trials and achieved higher yields. Arbosana is a type of fruit that looks enormously like Arbequina but ripens after 3 to 4 weeks and has 25% to 26% less energy than Arbequina. Koroneiki' is Greece's main oil type, produces the best oil, and has an impenetrable annual crop and protective effect. The value has the same as Arbequina, but the difference occurs in fruit size; it is smaller in size, and more energy is required to harvest the fruit (Paul *et al.,* 2007).

The results obtained for the length of the fruit and the width of the five olives showed significant results. Overall, data showed that fruits of the Arbiquina variety were recorded with minimal width, while fruit lengths were recorded slightly wider in the Pandolino varieties. The overall order of changes in fruit length and width was observed as follows: Kalamata>Leccino>Arbosona. Considering the overall results, it is well established that olive fruits showed variations in fruit length and width with different parameters in Arbiquina showing improvement in fruit length and width, which proved to be the best cultivar Similar findings reported by De la Rosa *et al.,* 2007 ho documented that all olive trees

cultivars fruit in kula during 2015, except Moraiolo no significant difference was found in the production of fresh fruit per tree, which was more than 22.06 kg/ tree for Koroneiki to a low of 0.25 kg/ tree for Arbequina. The main difference between the farmers was probably due to more variation, as only two trees were planted per farmer. For example, one Leccino tree gained 1.52 kg of fresh weight, while another Leccino tree produced 14.86 kg, which is about 10 times more than the first tree. Compared to the three cultivars Lalamilo, 'Arbosana' and 'Koroneiki' yielded much more yield in Kula, while 'Arbequina' yielded less, probably due to its late planting. Arbosana and Koroneiki at Kula fresh fruit production were within the range of the same crop grown for 3 years after planting in Spain. In our study, the total weight per plant of Arbosona variety had maximum yield per plant and Leccino variety had the minimum. Rest of all cultivars varieties showed an average yield of 3.58 to 5.21 kg per plant Padula *et al*., 2008 reported that average fruit weight and pulp to pit ratio, calculated from fruit samples of at least 50 fruits; the highest values of average fruit weight were observed in Metaponto and the lowest in Rossano. Oil content was highest in Rossano on a dry-matter basis and lowest in Metaponto on a fresh-matter basis. Our findings contradict the cited literature because of two main factors, i.e., average fruit weight calculated from a fruit sample of at least 50 fruits from each tree and in our study, 100 fruits weighted from each tree and the second difference may be the varietal difference The highest values of average fruit weight were observed in Kalamata variety and the lowest in Arbosona. The trend of 100 fruit weight was reported as Leccino>Pandolino>Arbiquina in olive varieties. Thus, our study strongly recommends that Kalamata, Leccino and Arbiquina olive varieties are suitable for oil production in the Quetta region. It was reported that oil production in 2013 was the minimal profitable production (Vossen, 2005), around 21% to 24%, i.e., Arbosana 21%, Arbequina 22% and Koroneiki 24%. Oil production in Argentina's orchards was 15.2%. (Trentacoste *et al*., 2010), 13.8% to 17.0% in Australian orchards (Mailer *et al*., 2011), and 17.9% in California orchards (Vossen, 2005). Oil production in Lalamilo in 2014 was much lower than in 2013, probably due to processing problems and is not recorded (Susan *et al.,* 2016). However, in the present study, no significant differences were observed in the physicochemical parameters of the oil extracted from the two olive cultivars, Coratina and Leccino, grown in Khuzdar and Loralai districts. Farmer Leccino had a better index of oil extracted (1.68 and 1.63) and cultivar Coratina (1.64 and 1.98) the values obtained were close to other types of olives in various parts of the world, from 1.46 to 1.47 described by (Ibrahim *et al.*, 2014). Both Leccino (186.4 and 186.5) and Coratina (195.6 and 198.7) remained the prime source of olive oil, thus promoting their cultivation (Imran, *et al.,* 2017). While our findings reported different aspects from reported literature that changes occurred due to climatic variations. Oil yield in Quetta in 2020 was above the minimum production ranging from 10% to 21%; the maximum production was founded in Kalamata at 21% and second in Leccino at 20% and the minimum production was founded in Arbosona at 10%.

Conclusion

The present study suggested that three olive cultivars, i.e., Kalamata, Leccino and Arbiquina were most suitable for cultivation in Quetta that established well in terms of their morphological attributes such as tree canopy, height, weight, oil and fruit yield by serving as a reliable tool for olive germplasm protection and conservation strategies and will help to improve the quality and quantity of oil and market opportunities.

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