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RESEARCH ARTICLE

Soil influence on the physicochemical profile of olive oil varieties *Chemlal*, *Sigoise* and *Oleaster* in western Algeria.

M. BENDI DJELLOUL[1*], S.M. AMRANI[2], B. BENDI DJELLOUL[2], A. EL HAÏTOUM[2]

1. Faculty of Natural Sciences and Life Sciences of the Earth and the Universe. Department of Agricultural Sciences, University Abou Bekr Belkaïd, BP119 Tlemcen, Algeria
2. Laboratory of Ecology and Natural Ecosystems Management, University Abou Bekr Belkaïd, BP119 Tlemcen, Algeria

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Corresponding Author

M. BENDI DJELLOUL

Abstract

This work is carried out to study the influence of the soil and the variety on the Algerian quality of the olive oils. The parameters of quality of oils of the dominant varieties Chemlal and Sigoise and the wild variety Oleaster as well as the parameters of the soil are given. The got results show that the three varieties of oil belong to the category of extra virgin olive oil. The influence of soil on the quality of the olive oil is a complex phenomenon; pH and chemical composition of the soil can influence the quality of the oil, the variety to be a major influence on the quality of the oil olive this case is confirmed in our study.

INTRODUCTION

The culture of the olive-tree is of a considerable importance for Algeria. It covers more than 200,000 ha and accounts for 49% of the tree orchard. Olive growing is localized mainly in Kabylie and in the Oranaise area. The number of tree planted is estimated at 32 million, with an average production, on the five last partners (2003/2004 to 2008/2009) of 39800 tons (or 1.4% of world production). Algeria is about to catching up with are delay and why not, to tear off a more honorable place in world classification. The production of oil reached 35 000 tons and that of olive of table 80 000 tons, compared with that of Tunisia the production of Algeria in the olive oil represents only one third. Projections of the production of olive oil, in Algeria at the horizon of year 2014 are based on the impact of the entry in production of new plantations and on the modernization of the processing sector. The olive oil is one of the main components of the mode known as "Mediterranean", known for its beneficial action on health (Jacotot, 1996). Its physicochemical and organoleptic characteristics are defined by the commercial standard of the International Olive Council (COI, 2009). Several parameters influence the quality of the olive oil such as for example, the variety and the degree of maturity of the fruits (Hajana et al, 1998), the soil (Demnati, 2008), (Dekhili et D'Hauteville, 2005) and altitude with which the olive grove is planted. The absence of data on the characteristics of the Algerian olive oils us with conduits to undertake work. The objective of this work is to study the physicochemical profile of olive oil and the effect of soil and the variety on the quality of these.

2. MATERIALS AND METHODS

2.1 VEGETABLE MATERIAL

Olive the samples of two dominant varieties and a wild variety were collected with the hand during partner 2009/2010. Two dominant varieties (Chemlal, Sigoise) were collected starting from the private olive groves located at Beni Snous, Sebdou and Remchi wilaya of Tlemcen. Wild variety (Oleaster) at summer collected with part of the wild Oleasters of the area of Ourit, wilaya of Tlemcen. The quantities of collected olives are of approximately 7 kg for each variety. After the gathering, the olives were cleaned of all impurities and then transported to the laboratory. The characteristics, synonym, zone of culture of origin of the studied varieties are represented in (table 1).

2.2 MATURITY INDEX

Determination of the maturity index at summer realized according to the method developed by the national institute of the agronomic researches of Jean in Spain brought back by (Rahmani, 1996), while basing itself on the color of the fruit (skin and pulp). On hundred fruits chosen randomly on a batch of one kilogram, the index of maturity (MI) is determined by the visual notation according to a scale of coloring from 0 to 7 variable of an intense green skin to a black skin and a pulp entirely violet.

2.3 OLIVE OIL EXTRACTION

The different varieties of olives have undergone extraction in order to recover the oil. This step was carried out using a laboratory oléodoseur (Levi-Deleo-Lerogsame). The extraction consists of a crushing of olives realized by a hammer mill, a malaxation of the paste carried out in two times: 15 minutes without water and 15 minutes after addition of 50 ml of water with 30°C for 920g of olive pastes and an oil separation by centrifugation carried out using a vertical centrifugal machine having a speed of 4845 turns/min; who separates the liquid phase from the solid phase. After decantation, oils are collected in bottles out of smoked glass, filled, labeled and preserved at a temperature of 4°C while waiting to be analyzed.

2.4 METHODS OF ANALYSIS

2.4.1 PHYSICOCHEMICAL ANALYSES OF OILS

2.4.1.1 Quality indices

The content of free fatty-acid or the acid value is an indicator of the activity of lipase as well as quality of the fruit, time of storage and stability of oil (Ryan et al, 1998)**.** The determination of acidity is carried out according to standard the EEC n°2568 (1991) equivalent with the method ISO 660 (1996) and equivalent with method UICPA n°2.201 (7th edition). Acidity is expressed as a percentage oleic acid. The peroxide index informs about the oxidation step of oil. It is given according to regulation the EEC n°2568 (1991) equivalent with the method ISO 3960 (1995) and equivalent with method UICPA n°2.501 expressed in oxygen millequivalents per kilogram of grease. Spectrophotometric indices are given according to the method of the International Olive Council (1996). Three tests were carried out for each parameter.

2.4.1.2 Physical indices

The refraction index is given according to the method ISO 6320 (1995) identical to method UICPA 2,102. 7th edition, the measures are taken with refractometer CETE with 20°C, with lines D of sodium, water circulation and adjustable temperature by thermostated bath. The density is given using a pycnometer according to the usual methods, graduated between 0.9 and 1 with 20°C; and this, according to the method ISO 6883 (1987) identical to method UICPA n° 2,101 7th edition. Water content which is the loss of mass.

2.4.2 PHYSICOCHEMICAL ANALYSES OF THE SOIL

This part starts the physicochemical analyses of the soil of the four olive groves or has to collect our olive samples, the parameters taken into account are: Texture, pH, total limestone, organic matter. To carry out the soil analyzes, we carried out the taking away of each olive grove by taking account of: Materials of taking away, Moment of the taking away, Place, depth and Conditioning of the samples. After drying of the samples, one with filtered manually using a sieve with opening of mesh of 2mm, we recovered the elements passing through the sieve and which is known as: is in hiding fine, useful for the realization of the analyses. The purpose of the granulometric analysis is to determine the texture of the soil, one evaluates the content of sand, clay and silt, for that one used the method of Standard; who bases on the phenomenon of variation in the time of the density of the mixture "soil-water" measured using a Densimeter; Then one uses a diagram which makes it possible to determine the class textural soil. The measurement of the reaction of the soil (acidity; alkalinity), is done has the assistance of a pH-meter. The unit of pH expresses the logarithm of the opposite concentration in ions hydronium (H^+). Among the chemical substances which use the composition of the soil: Limestone plays a crucial role not only in the nutrition of the plants but also in pedogenesis. In this analysis, one uses the calcimeter of Bernard who allows to measure the volume of ($C0_2$) released by Faction of hydrochloric acid (Hcl) on calcium carbonate ($Caco_3$) of a sample and to proportion total limestone of it. The content of carbonate of calcium is expressed as a percentage obtained to leave the following formula:

$$\% \ Caco_3 = \frac{P.V}{P.V} x100$$

V: Pure $CaCO_3$ Test portion
p: $C0_2$ Volume generated by pure $CaCO_3$
V: Soil test sample fine
p': $C0_2$ volume generated by fine soil.
For the Proportioning of organic carbon to used the method of Tjurin which consists in knowing the quantity of potassium bicarbonate which will oxidize the carbon of the organic matter in the presence of sulfuric acid. The percentage of (OC) is calculated by the following formula:

$$\% \ O_xC = \frac{Cx4x0,3}{G} x100$$ we note the volume of salt used

% O_xC : Percentage of oxidized carbonate.
4 Ml of 0.1N potassium dichromate.
0.3: Converting mg.
G: Sample size in mg of fine soil.
On taking the coefficient of Welts, one can calculate the percentage of humus in the soil:
Humus% =%O_xC. 1,72

3. RESULTS AND DISCUSSION

Figure 1 - Geographical location of the areas of studies

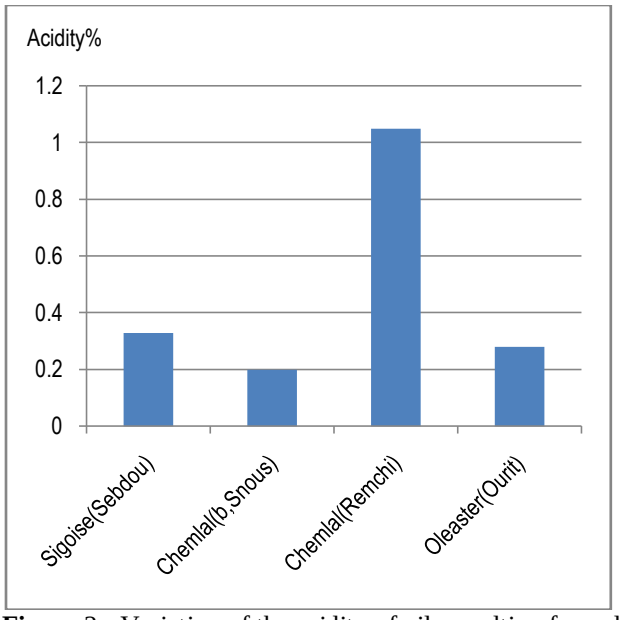

Figure 2 - Variation of the acidity of oils resulting from different varieties

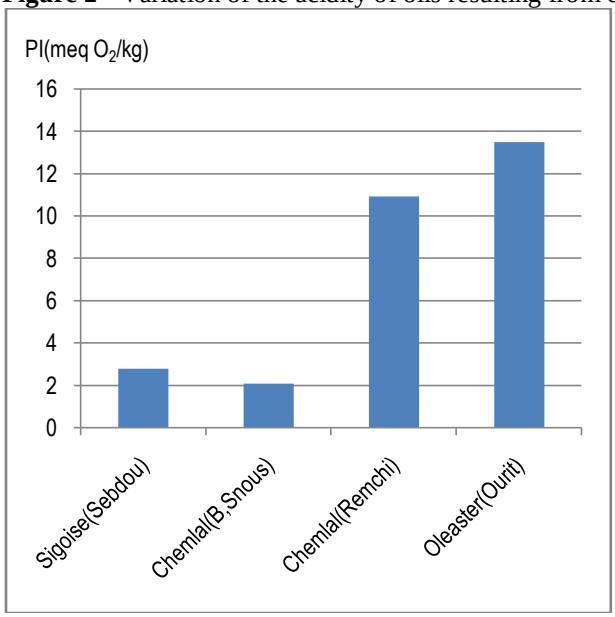

Figure 3 - Variation of the peroxide indices of oils resulting from different varieties

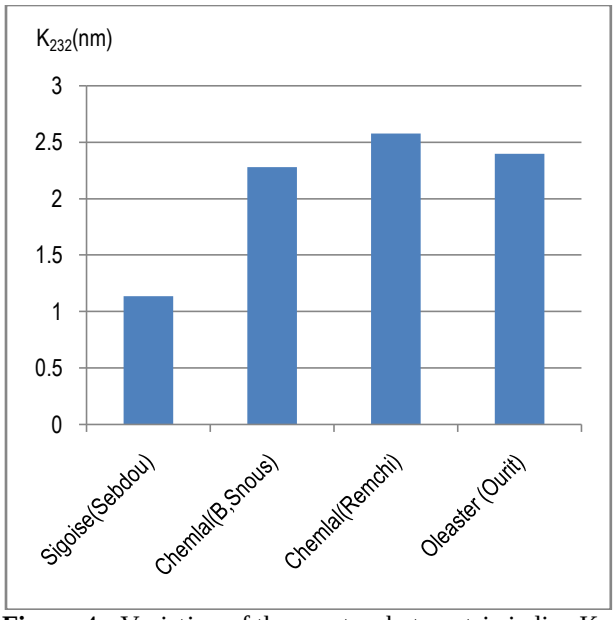

Figure 4 - Variation of the spectrophotometric indice K_{232} of oils resulting from the Different varieties

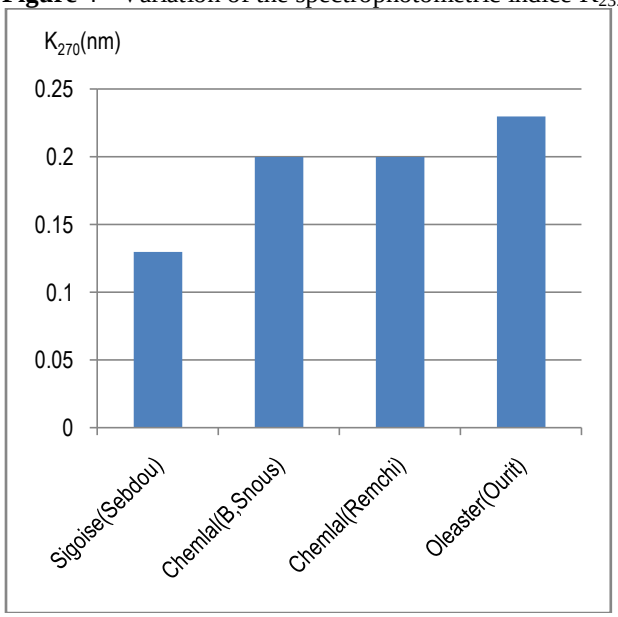

Figure 5 - Variation of the spectrophotometric indice K_{270} of oils resulting from the Different varieties

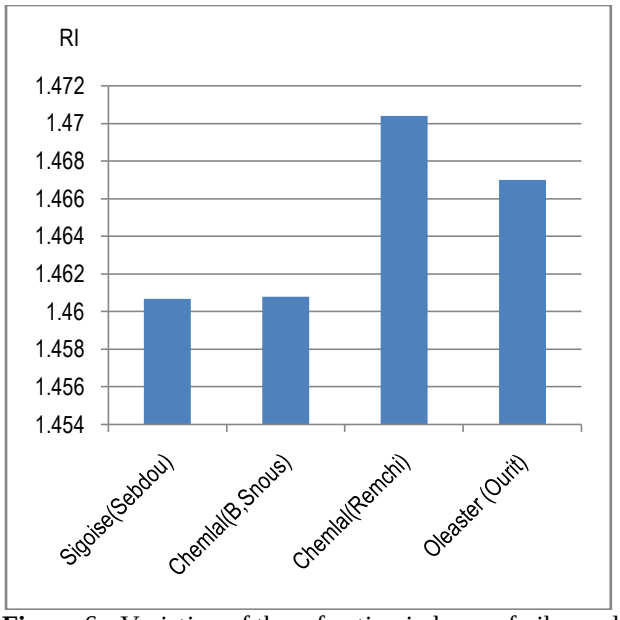

Figure 6 - Variation of the refraction indexes of oils resulting from different varieties.

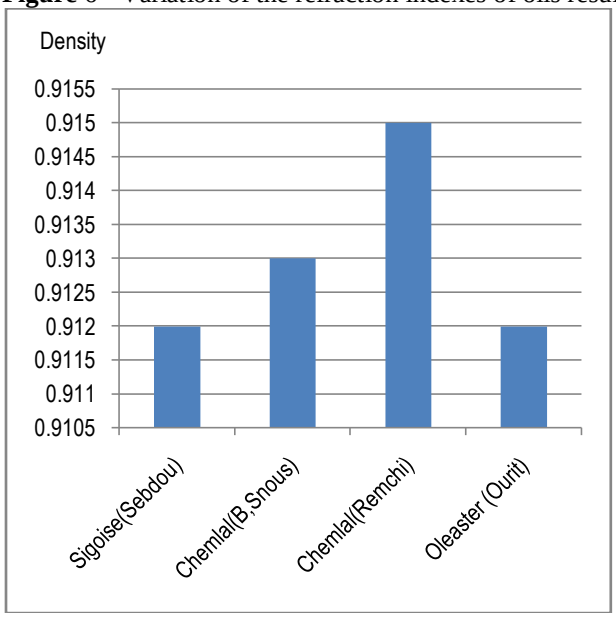

Figure 7 - Variation of the densities of oils resulting from different varieties

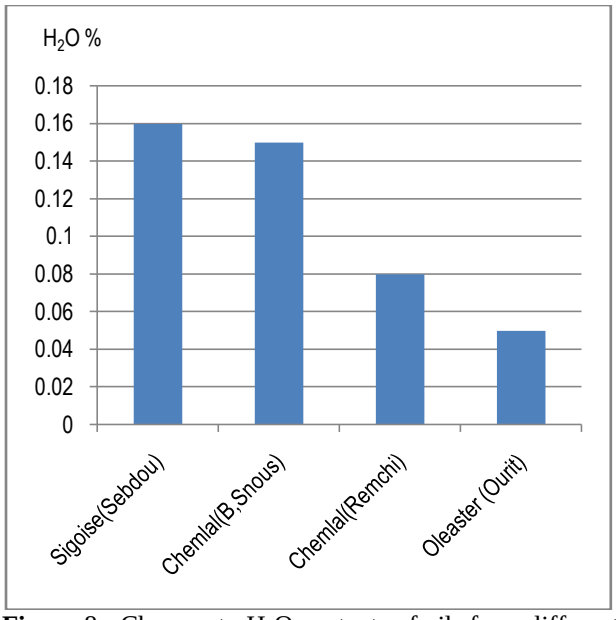

Figure 8 - Changes to H_2O contents of oils from different varieties

Table 1 - Primary characterization of the varieties of olives

Varieties	**Zone culture of origin**	**Fruit**	**Use**	**Tree**
Sigoise (olive of Tlemcen, olive of Tell)	Plain of Sig (Mascara)	Weak weight, forms ovoid, black color in full maturity	Olive of table oil	Fairly vigorous Port drawn up with an average density of the foliage
Chemlal (Achamlal, Achamli, Achemlal)	Kabylie	Weak weight, forms lengthened, black color into full maturity	oil	Strong strength Port drawn up with average density of the foliage
Oleaster (Zebbour, Sebboudj, Tazbboujt)	The Mediterranean	1/3 of olive cultivated, form lengthened , purple-blackish color into full maturity	Understock oil	With the vigorous temperament Short and squat trunk, often circumvented

Table 2 - Values of the maturity index of olives of the various varieties

Variety	**Maturity index (MI)**
Sigoise (Sebdou)	3.36
Chemlal (Beni Snous)	4.00
Chemlal (Remchi)	5.55
Oleaster (Ourit)	3.72

Table 3 - Results of the physicochemical analyses of the soil of the olive groves

Granulometry %	**Olive grove (Sebdou)**	**Olive grove (Remchi)**	**Olive grove (Beni Snous)**	**Olive grove (Ourit)**
Clay	37	37	34	26
Silt	40	40	35	40
Sand	23	23	31	34
Coarse sand	12	6	24	14

Fine sand	11	17	7	20
Gravel	19	19	15	11
Texture	silty clay	silty clay	silty clay	silty
pH	7.37	7.70	7.04	7.76
appreciation	alkaline	alkaline	neutral	alkaline
$CaCO_3$ %	18.4	11.73	10.13	8.53
Load $CaCO_3$	average	average	average	average
Organic carbon%	0.2	0.4	0.1	1
Estimate	Very weak	Very weak	Very weak	low
Humus %	0.3448	0.6896	0.1724	1.724

3. 1 MATURITY INDEX

The maturity index is a parameter which could inform us in a total way about maturity of the fruits. Got results (table 2) show that the two varieties cultivated with knowing Sigoise and Chemlal then have an maturity index which equalizes to 4, which varies for the wild variety Oleaster and equalizes 3.38. This variation can be related to the variation of the period of harvest being that the Oleaster variety is collected at one early time compared to the Sigoise varieties and Chemlal. This is probably related to the varietal effect following genetic factors; certain varieties enter in maturation more quickly than of others. Similar results are observed by (El Antari et al, 2003), which noted that the Moroccan variety Manzanilla distinguishes by its high speed of entry in maturity. Other factors can also influence the index of maturity of which the load of the olive-tree. According to (El Antari et al, 2000), borne fruit trees create a competition between fruit which caused low maturity index values at harvest time.

3.2 PHYSICOCHEMICAL ANALYSES OF OILS

The results revealed that the oil of the Chemlal variety (Beni-Snous) presents the percentage of acidity low 0.20%, followed by those of Oleaster (Ourit) and Sigoise (Sebdou) with percentages rather close to 0.28% and 0.33% respectively. These values of acidity are lower than the limit established by the COI which is of 0.8% for the virgin extra olive oil. However the oil of Chemlal (Remchi) displays the value highest 1.05%. The significant differences raised between the varieties can be related to the index of maturity of olives. Indeed, acidity increases with the maturity of the olive fruit (Yousfi et al, 2006), following an increase in the enzymatic activity especially the lipolytic enzyme (Salvador et al, 2001), (Ben Youcef et al 2010).Oils of the varieties Chemlal (Beni-Snous), Sigoise (Sebdou) and Oleaster (Ourit) are less acid than oils of the Tunisian varieties analyzed by (Zarrouk et al, 2008), for which free acidity are understood between 0.38 and 0.41% of oleic acid, they are close to oils of the Spanish varieties Picual, Cornicabra, Manzanilla, Arbequina and Local whose values are between 0.10 and 0.25 % (Pardo et al, 2007) and European varieties of oil introduced in Tunisia and the Tunisian variety Chemlali whose contents range between 0.11 and 0.28 % (Dabbou et al, 2010). Concerning the peroxide index, analyzed oils show values which vary between 2.1 meq O_2/Kg for the variety Chemlal (Beni Snous) and 13.5 meq O_2/Kg for the wild variety Oleaster (Ourit). The values reached are lower than the standard of (COI, 2009), for the olive oils of extra category virgin and virgin (20 meq O_2/Kg). Oils of the varieties Chemlal (Beni Snous) and Sigoise (Sebdou) present peroxide indices close to those recorded for oils of the Tunisian varieties Chétoui, Jarboui, Ain Jarboua, Neb Jmel, Rekhami, Regregui which vary between 2.63 and 7.90 meq O_2/Kg (Haddada et al, 2008). While oils of the varieties Chemlal (Remchi) and Oleaster (Ourit) present peroxide indices close to those of the Turkish varieties (between 7.37 and 16.08 meq O_2/Kg) (Ocakoglu et al, 2009).Concerning spectrophotometric indices (K_{232}, K_{270}), the value highest of the K_{232} coefficient is recorded for the variety Chemlal (Remchi) (2.58) and the lowest value for the variety Sigoise (Sebdou) (1.14). As for the K_{270} coefficient the variety Sigoise (Sebdou) presents the lowest value (0.13), whereas the varieties Chemlal (Beni Snous) and Chemlal (Remchi) present the same value (0.20). The variety Oleaster (Ourit) presents the value highest (0.23). Various oils of the varieties present refraction indexes (RI) very close which range between 1.4607 and 1.4704. For the density, the values are close and ranges between 0.912 and 0.915. Concerning the water content (H_2O%) the varieties Sigoise (Sebdou) and Chemlal (Beni Snous) present the highest values (0.16) and (0.15), where as the values lowest are varieties Oleaster (Ourit) and Chemlal (Remchi) with (0.05) and (0.08). The results of analyses (acidity, peroxide index, K_{232}, K_{270}, Density, RI and H_2O% content) carried out on the oils produced starting from the studied varieties fit all perfectly in the limits defined by (COI, 2009), for a virgin olive oil extra, which enables us to classify oils exit of the varieties Sigoise (Sebdou), Chemlal (Beni Snous), Oleaster (Ourit) in this category, except the oil of the variety Chemlal (Remchi) which is to downgrade of

virgin olive oil category; this result can be related to an exposure of olives and extracted olive oil with the air and the light. The warming of the olive paste and a long mixing time are not to rule over-non (Tanouti et al, 2010).

3.3 ANALYSIS PHYSICOCHEMICAL OF THE SOILS

Concerning the texture of the soils of different the olive groves (table 3), the olive grove (Sebdou) and (Remchi) show the same sand rate (23%), whereas for the olive grove (Beni Snous) and (Ourit) it is of (31%) and (34%). The olive groves (Sebdou), (Remchi) and (Ourit) raised the same rate of silt (40%), while the olive grove (Beni Snous) with statement (35%) of silt. The olive groves (Sebdou) and (Remchi) show the same clay rate (37%), whereas for the olive grove (Beni Snous) and (Ourit) it is of (34%) and (26%). For the pH, the olive grove (Beni Snous) low has the pH with (7.04) and the olive grove (Ourit) has the highest pH with (7.76), the olive groves (Sebdou) and (Remchi) recorded a pH of (7.37) and (7.70). As for total limestone for the olive groves (Sebdou) and (Remchi) the rate is from (18.4%) and (11.73%) and for the olive groves (Beni Snous) and (Ourit) the rate is of (10.13) and (8.53). The contents of organic carbon are of (0.1%) and (0.2%) for the olive groves (Beni Snous) and (Sebdou) and of (0.4%) and (1%) for the olive groves (Remchi) and (Ourit). Concerning the content of humus for the olive groves (Sebdou) and (Remchi), it is of (0.344%) and (0.689%) and of (0.172%) and (1.724%) for the olive groves (Beni Snous) and (Ourit). Have base themselves on the triangle of Demelon, it arises that the soils of the olive groves Sebdou, Remchi and Beni Snous are of argillaceous muddy texture except the Ourit olive grove which is muddy. The various soils of the olive groves have an alkaline pH except the olive grove Beni Snous which with a neutral pH. The various olive groves present a limestone average charge. Where as the rate of organic carbon remains very weak with weak in all the olive groves.

4. CONCLUSION

In the present study, our objective consisted in studying the influence of the soil and the variety on the quality of some olive oils in the Wilaya of Tlemcen (Western Algeria). The results of this study made it possible to give a first appreciation of quality and effect of some parameters on the composition of the olive oils of the Algerian varieties, Sigoise, Chemlal and Oleaster. The results of the evaluation of the parameters of quality showed that oils of the varieties Sigoise (Sebdou), Chemlal (Beni Snous) and Oleaster (Ourit) belong all to the category of the virgin olive oil “extra”, except the oil of the variety Chemlal (Remchi) which is classified like virgin olive oil. The influence of soil on the quality of the olive oil is a complex phenomenon; pH and chemical composition of the soil can influence the quality of the oil, the variety to be a major influence on the quality of the oil olive this case is confirmed in our study. Traditional Algerian olive growing, particularly in the Wilaya of Tlemcen is characterized by heterogeneity, which is due not only to climate variability but also the agronomic, technological and varietal. It would be interesting to continue this study by considering a number of years of samples and more importantly, at all olive-growing regions of the Wilaya; assess qualitatively and quantitatively the largest possible number of parameters and indices which were not addressed in this study.

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