University of Mohamed Khider Biskra
Faculty of Exact Sciences and Natural and Life Sciences
Department of Agronomic Sciences

MASTER MEMORY

Science of Nature and Life
Agronomic Sciences
Vegetable production

Réf. : ……

Made and Presented by:
Gouacem lina

The :

Theme:

Variability of physicochemical properties of three date palm cultivars fruits collected from different oases in ziban region .

Jury :

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Dedication

All that I am, or hope to be, I owe to my angel mother.

To the purest soul and most beloved man on earth my father.

To god's most precious gift, my little sister Nermine.

To my forever rocks and strength my brothers Bilal and Aymen .

To my absolute favorite people and best company that a person could ask for:

Ahlam that I don't know the world without, Hayat that keeps my dreams alive and never make fun of them, Rayan that always took good care of me and supported me with her sweet words And Thaziri that we always push each other's to achieve more and do better by competing.

To all the people that I have met in this 5 year and influenced me, support me or try to put me down, you all play your parts in making me who I'm so thanks to you all.

With love

Lina

Institutes

D.S.A: Department of Agricultural Services.

F.A.O: Food and Agriculture Organization of the United Nations.

I.P.G.R.I: International Plant Genetic Resources Institue.

Other:

%: percentage

° C: degree Celsius

ACM: Multiple Correspondence Analysis

CHA: Ascending hierarchical classification

Cm: centimeter

Cos^2: square cosine

Ha: hectare

G: gram

H: hour

Kg: kilograms

Meq / 100g: melliéquivalent per hundred gram

Mg: milli gram

Ml: milliliter

Mn: minute

N: normality

t: ton;

Ppm: part per million

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INTRODUCTION

The date palm is the welfare tree of the desert regions where it grows. It gives a wide range of products, and first of all: dates, food of great energy value, which can be transformed (pasta, jams, cream, flour, etc.) will always find a widely open market (Toutain, 1967) . Currently Algeria is counted among the most important date producing countries in the world. It is ranked the third producer with 934,377 Tons (FAOSTAT, 2014) and around 940 cultivars (Hannachi et al, 1998). Algerian date production is renowned throughout the world through the "Deglet-nour", a noble variety, an excellent palate date highly prized on the world markets (Tirichine, 2010). The date palm *(Phoenix dactylifera L.)* is one of the most important crops in the arid areas of North Africa. The dioecious character of the date palm has resulted in great variability when propagated by seed. The genetic diversity of the date palm allowed the selection of a large number of clones with morphological and physiological characteristics.

In terms of production, the wilaya of Biskra also ranks first nationally, with 41% of the volume (DSA Biskra, 2016). According to Benziouche (2012), edaphic and climatic specificities, cultivation management as well as the value of the varieties explain this importance of production and yields in the region. On the Algerian market, dates do not always look the same, that of Tolga is the most coveted and sought after by consumers given the superior quality it presents in terms of size and taste. Locally, phoeniculturists visually recognize the qualitative differences in Deglet Nour dates and in some cases, they can even attribute them, with ease, to a particular region which testifies to a fairly detectable variation in the characteristics of Deglet Nour dates. . This variation is due to environmental effects when environmental conditions are different between individuals (Fraimout, 2016). Indeed, according to khachai (2017), the quality of dates is influenced by the type of cultivar and by environmental conditions. It is this phenotypic variation that aroused our interest since it is a response of the genotype of the cultivars Deglet Nour, mech Degla, Degla bida. to extrinsic climatic, edaphic and cultural factors. An answer which, once understood, would allow better management of production in terms of quality and quantity.

In fact, our work Focuses on the study of intra-clonal phenotypic variation in cultivars of Deglet Nour. Mech degla. Degla bida. by the use of some morphological and chemical markers of dates. The objective is to understand the extent and nature of the change in the

characteristics of dates in different environments and to see which markers are more influenced by the environment. To achieve these objectives, the main question that we have formulated and which we propose to answer in this work is to know: Is there intra-clonal phenotypic variation in cultivars? And which of the parameters we have studied vary the most?

To achieve these objectives and answer these questions we followed the following methodology: At the beginning we carried out a bibliographic search comprising three chapters, in the first we retained the basic concepts of date palm cultivation, the second studied the plant genetic resources date palm and the last details the biochemical composition of the date The second part concerns the experiment, it comprises two chapters, the first illustrates the methodology followed and the second presents the results of the variation through morphological and chemical analyzes and statistical treatments for the evaluation of dates from the date palm harvested from four different municipalities, namely: Tolga, Sidi okba .Ain naga and Bordj ben azouz.

FIRST PART BIBLIOGRAPHIC SYNTHESIS

Generalities of date palm

Introduction

According to Chaibi et al (2002), Bezato (2013) and Chaouche Khouane (2012); the date palm (*Pheonix dactylifera L.)* is a dioecious fruit species with allogamous reproduction which has been cultivated since antiquity. It is cultivated for different uses:

- Particularly their edible fruits (dates), known, cultivated and marketed;
- Adaptation to severe climatic conditions;
- Creation of a microclimate that promotes the development of various forms of animal and plant life.

1. Insights into the date palm

1.1. Origin and history

The origin of this species is still unknown, including according to Djerbi (1996); there are two explanatory hypotheses:

- The date palm is the result of a cross between one or more wild forms of palm (distribution area extends from the Indus valley to the Canary Islands)
- The date palm is a result of species of the genus Phoenix existing in its area of dispersal.

But at the level of the Maghreb and according to the same author, there are three logics of introduction of date palm by:

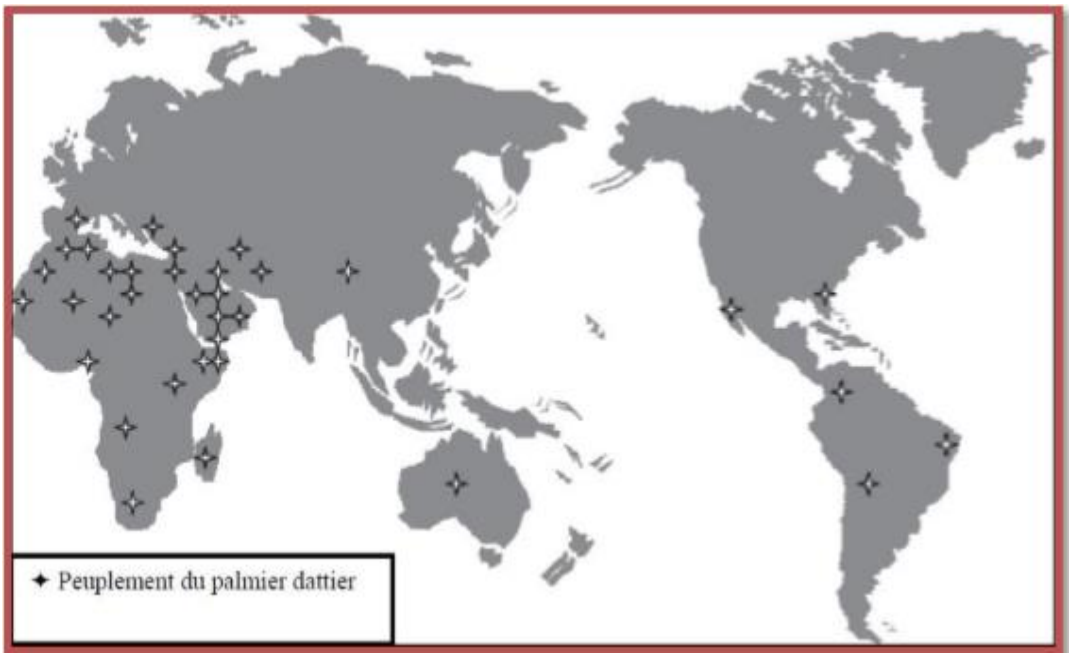
- The cores carried by the slaves of the caravan trade in 790.
- The peasant selection (15th century) where maritime navigation will begin, which replaced the journey through the Sahara, from which the best varieties of date palms were selected by the natives.
- Colonization which favors the planting of Deglet-nour to the detriment of other cultivars.

Geographical distribution

1.2.1. In the world

The date palm's range is spread over the northern hemisphere between the parallels 9 ° 18'(Cameroon) and 39 ° 44' (Elche Spain). (Toutain, 1967).

According to Ben Abes (2011) the date palm exists in the five continents, it is cultivated intensively in the arid and semi-arid zones of Africa, the Middle East and in Spain (the only European country producer of dates), and in low intensity at the level of Mexico, Argentique and Australia (Figure 01).



(Elhadrami , 2009)

Figure 01: Distribution of the date palm in the world.

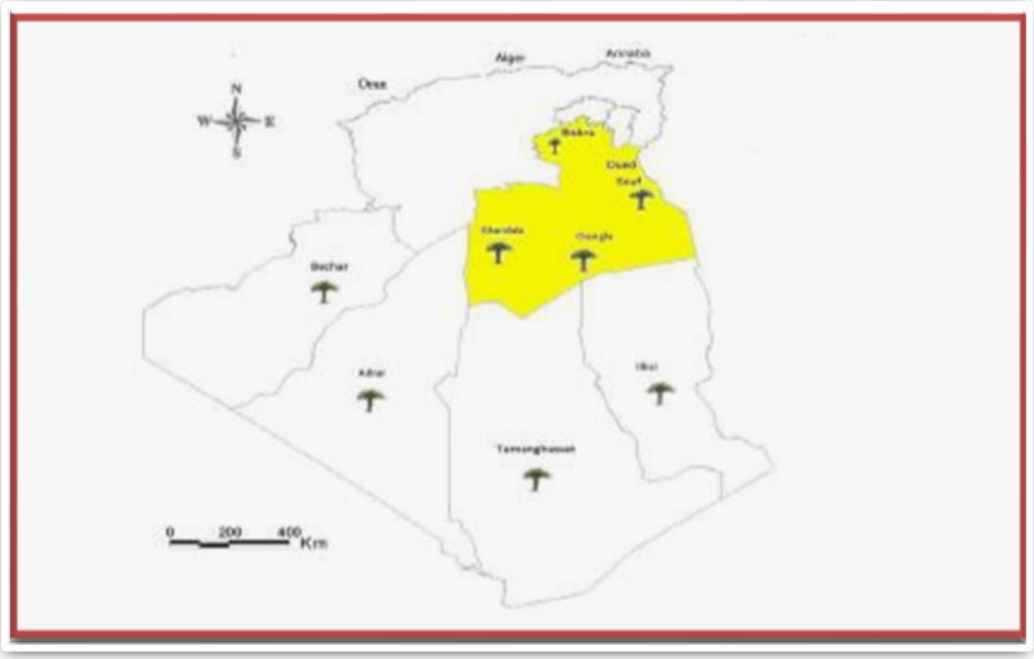
1.2.2. In Algeria

The cultivation of the date palm occupies all the regions located under the Saharan Atlas, 6000 ha from the Moroccan border in the West to the East Tuniso-Libyan border. From north to south of the country, it extends from the southern limit of the Saharan Atlas to Reggane in the west, Tamanrasset in the center and Djanet in the east (Matallah, 2004).

According to Babahani (2011), palm groves are located in the following geological zones:

- Ziban in the North-East of the Sahara (Biskra, Tolga, Sidi Okba…)
- Oued Righ south of the Ziban (Mghaïr, Djamaa, Touggourt)
- Souf in the southwest of Oued Righ (El Oued, Guemar, Débila,)
- Ouargla to the southwest of Oued Righ (El Bour, Ngoussa, Rouissat,)
- Mzab west of Ouargla (Ghardaïa, El Attef, Bounoura,)
- Dayas region to the north of the chebka of Mzab (Laghouat, Boussaâda, Ouled Rahma, Ouled Harket,)
- El Menia region, south of Mzab (eastern edge of the great Erg Occidental)
- Gourara located between the great Erg Occidental to the north and the Tamait plateau to the south (Timimoun, Aoughrouth, etc.).

- Touat, located between Oued Messaoud and Oued 1'Rmal, up to the Sebkha of Timi (Tssabit, Sbaa, Tamentit, Zaouit Kounta,).
- Tidikelt located between Aoulef in the West and In Salah (included) in the East (In Ghar, Tir, Akabli,).
- Saoura in the southwest of the Saharan Atlas between the Hamada de Ghuir and the great Western Erg (Beni Ouanif, Bechar, Abadala, Taghit, Beni Abbès…).
- Tindouf in the extreme southwest, located between the hamada ghuir in the north and the Eglab massif in the south.
- Hoggar, Tuaregs region located at the extreme south of the Sahara (In Amguel, Tamanrasset, Timiaouine, In Guezaam,).
- Tassili region of Tuaregs also located in the North-East of Ahaggar (Illizi, Djanet, Ihrir, Djarat,…).
- According to Bessas (2008), three-thirds of the phoenicultural heritage is located in the regions of Ziban, Oued Righ and the Ouargla basin (Figure 02).



(Dakhia and al., 2013)

Figure 02: Distribution of the date palm in Algeria.

1.3. Systematic of the date palm

According to recent data from the International Code of Botanic Nomenclature (Moore, 1963; Bransfield, 1999; Henderson, 1999 in El-Houmaizi, 2002) the date palm occupies the following place in the plant kingdom:

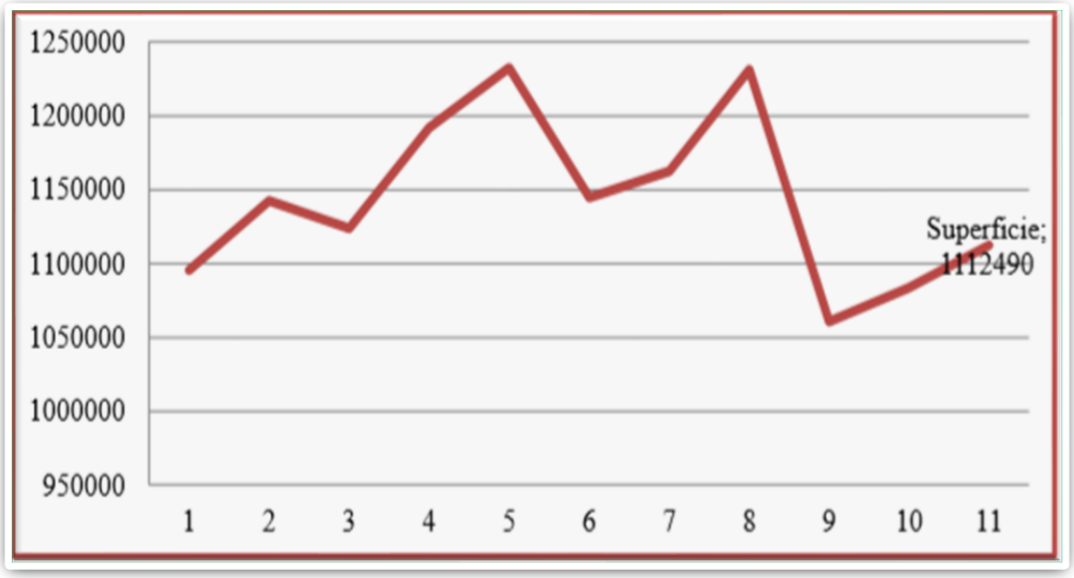
- Phylum: *Angiosperms*
- Class: *Monocotyledons*
- Order: *Principles*
- Family: *Areacaceae*
- Tribe: *Pheniceas*
- Genre : *Phoenix*
- Species: *Phoenix dactylifera L.*

2. Importance of date palm

2.1. In the world

The total number of palm trees is estimated at 200 million plants distributed in more than thirty different countries (Hasnoui, 2013).

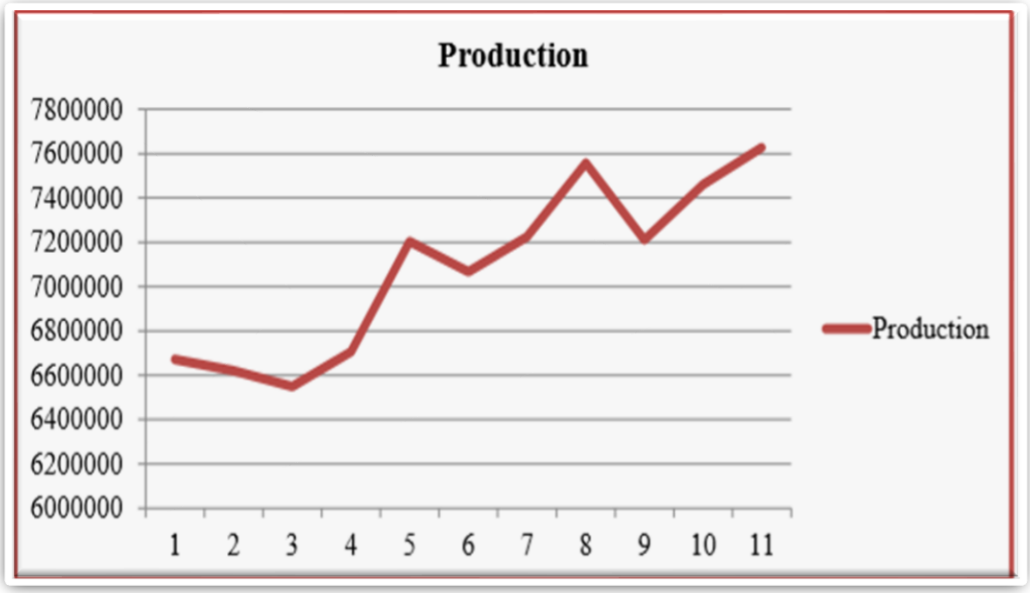
The importance of this sector is marked by the evolution of the consecrated area of which in 2003 is 1,095,452 Ha and in 2013 is expressed by 1,112,490 Ha according to FAOSTAT statistics (Figure 03).



FAOSTAT, 2015

Figure 03: Evolution of the world surface area of the date palm (2003 - 2013).

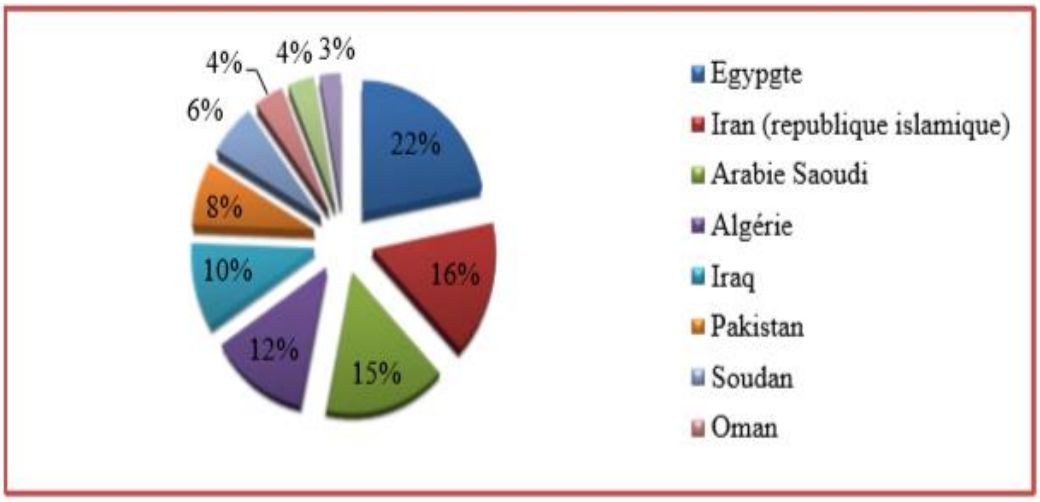
As well as the increase in production reported in the same period which reached 6,670,862 tonnes (T) in 2003 and 2013 is met by 7,627,624.40 T (Figure 04)



FAOSTAT, 2015

Figure 04: Evolution of the world production of date palm (2003 - 2013)

In 2013 and in the world ranking of the FAOSTAT (2015) we show that: Egypt occupies the first place with a production 1,501,799 or 22%, in second place the Islamic Republic of Iran (1,083,720 or 16%) followed by Arabia Saoudi (1,065,032 or 15%) and in fourth place Algeria with an 848,199 production (12%) (Figure 05).

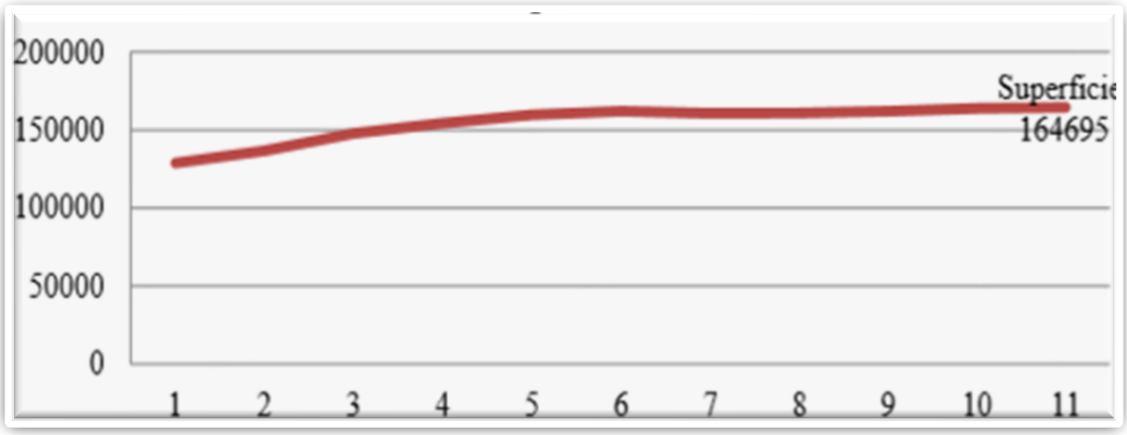


(Miloudi.B from FAOSTAT, 2015.)

Figure 05: Distribution of the date production palm in the world in 2013

2.2. In Algeria

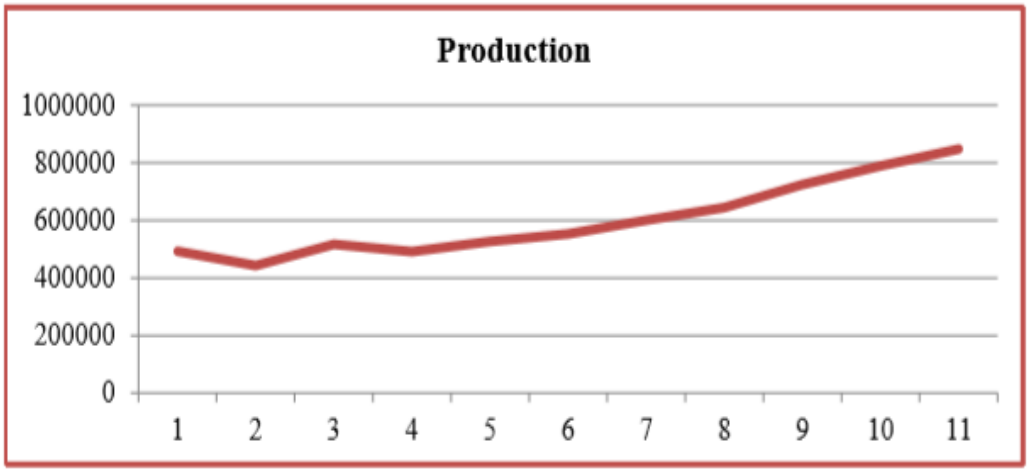
According to Benziouche and Cheriet (2012), phoeniciculture in Algeria is considered as the central pivot around which Saharan agriculture revolves. This importance can be expressed either by the change in the number of plants recorded, which were 9 million in 1996 rose to 15 million in 2005 and to 16.5 million in 2008 and which was around 17 million in 2011, i.e. by the increase in the area occupied by this crop: 128,800 Ha in 2003 reached 164,695 Ha in 2013 (FAOSTAT, 2015) (Figure 06).



FAOSTAT, 2015

Figure 06: Evolution of the surface area of the date palm in Algeria (2003 - 2013).

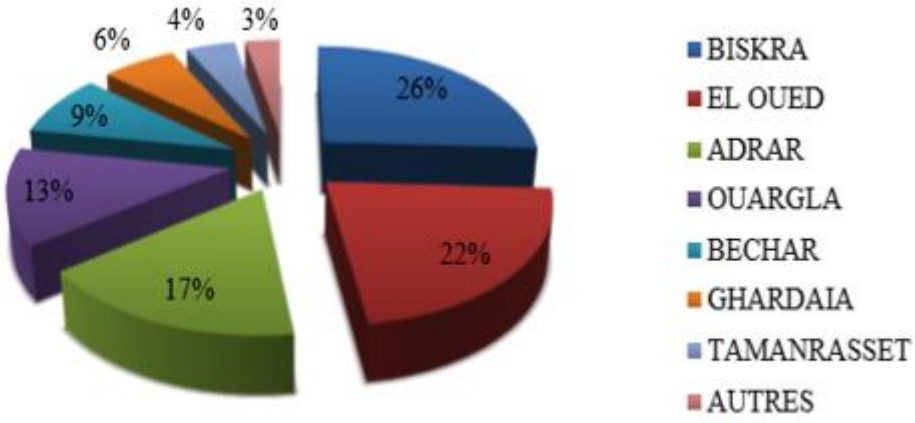
Similarly, production increased from: 492,217 t in 2003 to 848,199t in 2013 (FAOSTAT, 2015) (Figure 07)



FAOSTAT, 2015

Figure 07: Evolution of date palm production in Algeria (2003 - 2013)

In Algeria and according to statistical data from DSA de Biskra (2015), the pilot wilayas in the phoenicultural sector are: Biskra, El-Oued, Adrar, Ourgla, Bechar, Ghardaia and Tamanrasset by the area occupied and which are classified in order descending (Figure 08).

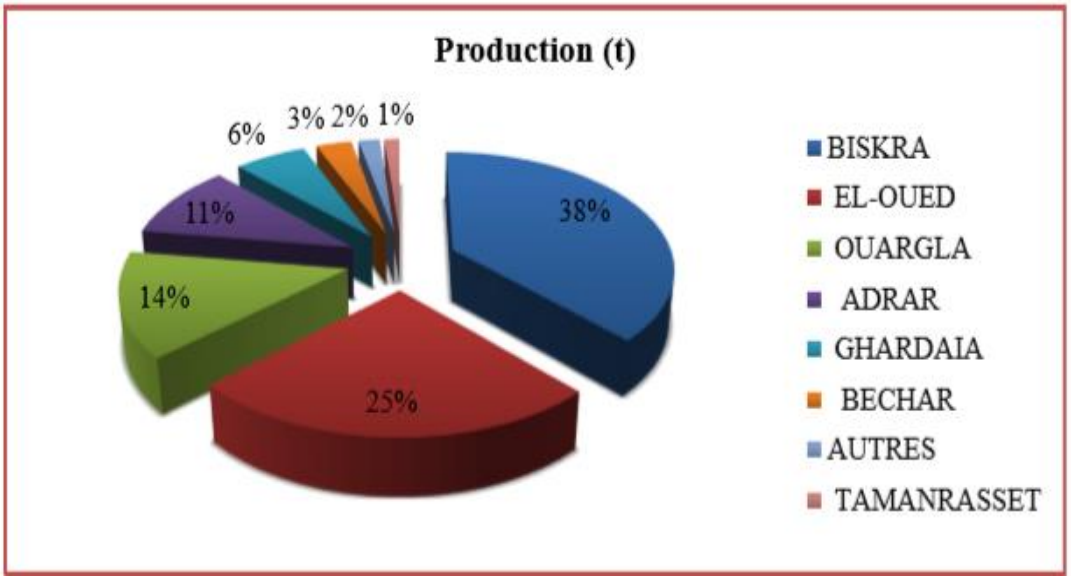


FAOSTAT, 2015

Figure 08: Spatial distribution of the date palm in Algeria (2013).

- And in terms of production are ordered as follows:

Biskra, El Oued, Ouargla, Adrar, Ghardaia, Bechar and Tamanrasset (Figure 09).



FAOSTAT, 2015.

Figure 09: Distribution of date palm production in Algeria (2013).

Of which the Biskra region occupies first place nationally because it devotes an area of 42,493 Ha or 26% to produce 321,440 t or 38%.

2.3. In Ziban region

The Ziban region is characterized by the quality of its precisely Degletnour or Elite dates. According to data from DSA (2015), the phoenicicol heritage of this region in 2013 is estimated at over 3 million feet located in an area of 42,493 Ha, of which Deglet-nour occupies 60%, Degla Bieda and the like (dry date) 27% and Ghars and the like (soft date) by 13% (Figure 10).

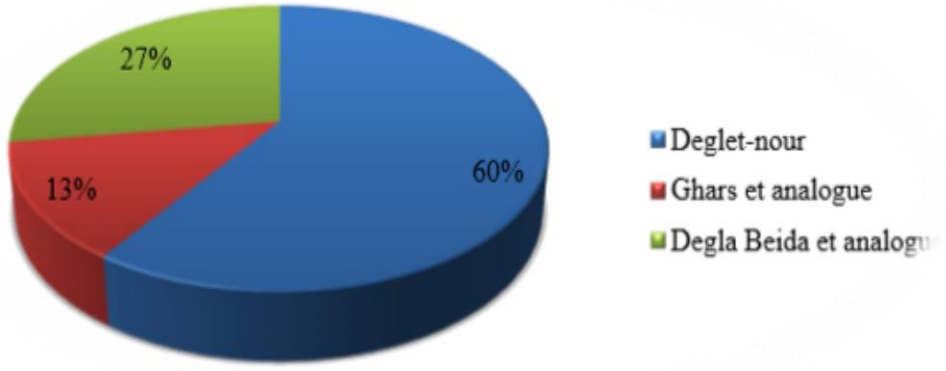


Figure 10: Distribution of the number of plants of each cultivar in Ziban (2013).

Chapter 2:Importance of date genetic resources

1.1. date palm geneti

c resources status in the world

According to Hasnaoui (2013), the date palm is represented by around 5,000 cultivars, the majority of which are low to medium quality cultivars. The distinction between these cultivars is made during the period of fruiting on a determined number of individuals (because the floral organs are almost the only ones to show stable characters). the main cultivar in Arab world represented in table 1.

Table 01: Dominant cultivars in the main Arab date-producing countries.

Origins of cultivars	Cultivars Numbers	Cummins names of some of the famous cultivars	Références
Maroc	223	Mejhoul, Boufeggous, Bouskri, Jihel, Aziza Bouzid, Assiane, Najda (Clone Séléctionné).	Pereau-Leryo (1959) ; Saaidi (1987) ; Haddouche (1996) ; Sedra (2003).
Tunisie	305	Deglet Nour, Allig, Horra, kenta, Arechti, Gosbi, Bser Hlou.	Rhouma (2005) ; El Arem and al (2011).
Algérie	940	Degla Beida, Deglet Nour, Thoory, Himra, Tazizawt, Ghars.	Hannachi et al (1998).
Libye	400	Saâdi, Khadrawi, Taliss, Elbekrari, Ettabouni, Sahra, Taghyat.	Echarfa (1983) ; Ismail (1998).
Mauritanie	350	Ahmar, Tinterguel, Sekani, Amsersi	Munier (1973).

Soudan	200	Berkawi, Bentmouda, Mechrqui, Elmadina, Koumla	Mohamed (1988).
Egypte	-	Zaghloul, Hayani, Samani, Oummahat, Alarabi, Essiwi, Ghazali.	Atif and Nadif (1993)

(Hasnaoui, 2013)

1.2. Distribution of genetic diversity in Algeria

According to Bousdira (2007), we noticed the following distribution (Figure 11):

- In the south of the Sahara: biological diversity is important but the Deglet-nour predominance is accentuated. In the mountain palm groves of Aurès Nememcha (171 cultivars), in the valley of Oued Righ (121 cultivars) and in Ziban (115 cultivars), Souf (69 cultivars) and Ourgla (59 cultivars).
- In the Central Sahara: many cultivars have been introduced into M'zab from palm groves in neighboring regions: Ourgla, Oued Righ, Souf and even Ziban. Au M'zab (except El Menia) has identified 125 cultivars, the most frequent of which are: Azerza, Bent Qbala, Tadala, Ghars, Timjuhart, Deglet-nour.
- In the Foggaras region: the climatic conditions of this region do not allow the cultivation of Deglet-nour, on the other hand, it conceals many cultivars: 230 in Gourrara, 36 in Tidikelt and 184 in Tassili.
- In the Saoura region: there are some 130 cultivars, including the Boufaggous variety, unfortunately sensitive to bayoud.

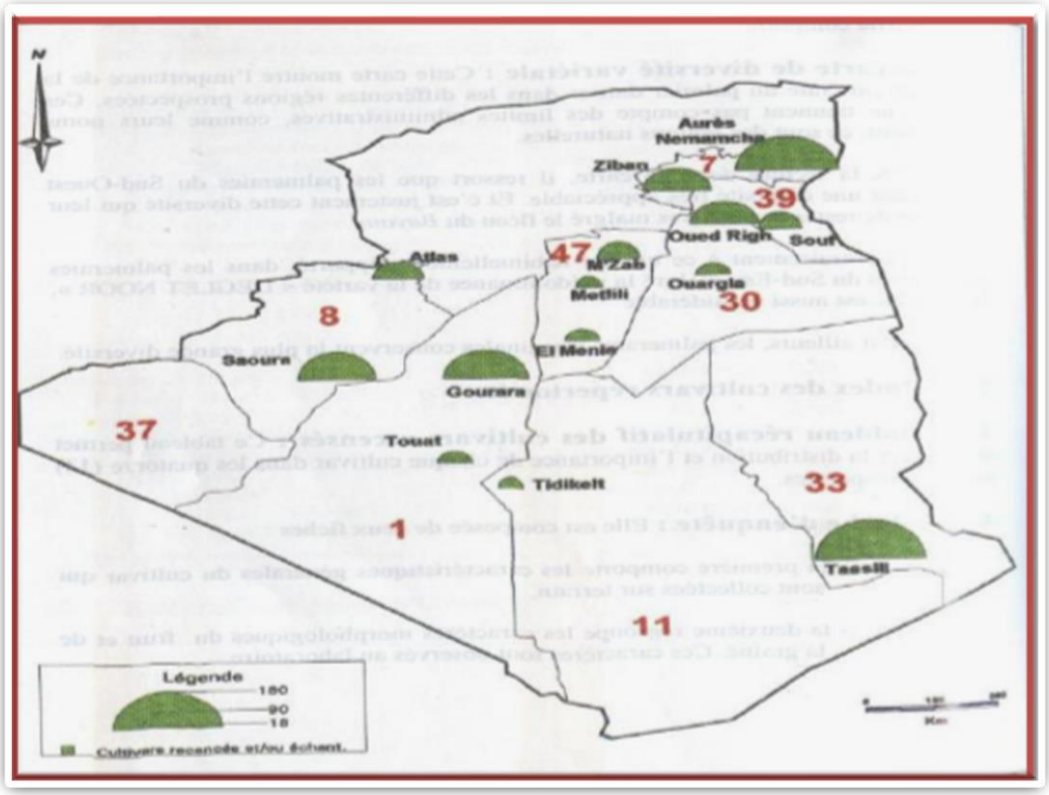


Figure (11): Map of the varietal diversity of the Algerian date palm.

I.3- In the Ziban region

The Ziban region is one of the country's most important phoenicultural regions in terms of heritage and quality of production. The Ziban region is the second largest date producing region after Oued-Righ. On a phoenicultural heritage estimated at more than 1.9 million palm trees, the Deglet-Nour variety alone occupies more than half of the date orchard. The number of date cultivars in the Ziban region is estimated at more than a hundred. However, out of the hundred cultivars identified, only three (Deglet-Noor, Mech-Degla and Ghars) are of real economic importance.

Table 02: number of cultivars in the different localities of Ziban

Localities	Number of cultivars	Localities	Number of cultivars
Sidi okba	84	Bouchagroun	31
M'ziraa	60	Ouled djallal	31

El-haouech	57	Laghrous	31
Djamoura	51	Sidi khaled	31
Lioua	50	M'lili	29
Ourelel	45	Oumech	25
Tolga	44	Mchounech	24
El outaya	40	Elhajeb	24
B b azzouz	39	Ain naga	19
KH sidi nadji	36	Foughala	19
Lichana	35	Chatma	18
Mkhadma	34	El-feidh	11

(Belhadi et al, 2008)

From the point of view of varietal diversity, according to Belhadi et al. (2008), the inventories carried out in the Ziban oases, locality by locality, show that Ziban contains a large number of cultivars. Sidi Okba is home to the largest number of cultivars (84). On the other hand, the locality of El Feidh records the lowest number of cultivars (11). On the other hand, we observe that almost half of the areas of palm groves are located in the Wilayas of Biskra and El-Oued (Table 03).

Table 03 : Date palm production and area per wilaya in (2013)

Wilaya	Area (ha)	Production (t)
Adrar	27 804	87 522.3
LAGHOUAT	318	13 28
BATNA	193	13 96
Biskra	42 493	3 214 40
Bechar	13 945	257 45
Tamanrasset	7 001	110 99
Tebessa	812	1,850
DJELFA	100	4 92

Ouargla	21 515	1 212 54
Illizi	1,220	1,530
Tindouf	434	7 45
El-Oued	36 317	2 137 52
Ghardaïa	10 632	910 400

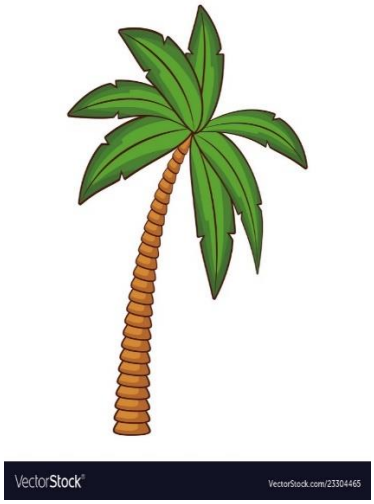
(A.D.S Biskra 2015)

Intra clonal clonal variation

According to chott M. Variation of climate condition (temperature and humidity) in oases could induce more disorders in composition and quality of date fruit, as well as significant changes in SSD, sugars content, total fiber content and water activity than in morphological characters (length, width and weight). So, climate change could affect directly and indirectly the production and quality of date fruits in different oases

They showed that the morphological characteristics of the fruit and the seed allowed the distinction not only between some cultivars of southwest Algeria but also within the same cultivars (intra cultivar variation) which seems to be genetic. effect an intra cultivar variability due to the environmental influence which affects the morphology of the fruit. not far in the Touat region (wilaya of Adrar). named by the great diversity of the date palm. 193 cultivars were inventoried of which 88 were made object of a phonological and morphological characterization 75 of the fruiting bodies (zaki,2011 in bedjaoui 2019).

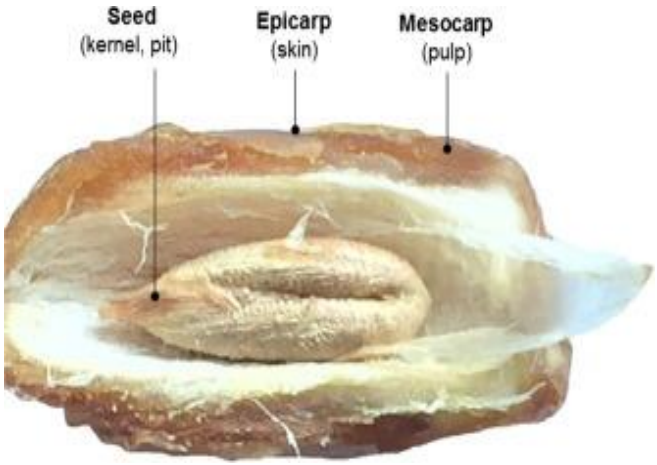
Chapter 03: Biochemical composition of the date and the criteria of its evaluation.



1. **Biochemical composition of the date**

1.1. Definition of the date

According to Babahani (2011), the date has a berry shape, it contains a single seed commonly called a kernel. It is composed of a mesocarp coated by a thin epicarp and the endocarp (very thin membrane surrounding the seed) (Figure 13).



(I.S. Al-Mssallem, *et al.2013)*

Figure 12: Date pulp and pit.

1.2. Formation and maturation of the date

According to Munier (1973), the five stages of phenological maturation of the date are:

- **First stage**: khalal is the stage immediately following pollination. The date has a spherical shape, cream in color. The evolution of the fruit is very slow. This stage lasts 4 to 5 weeks after pollination.
- **Second stage:** Blah The date begins its development, grows and takes on a green tint (apple green). This stage extends from June to July, it constitutes the longest phase in the evolution of the date, and lasts 4 at 7 weeks.
- **Third stage:** Bser is the developmental stage of the date during which the fruit takes its final shape and size, and it changes from its green color to a generally yellow or red color, rarely greenish. The period of this stage lasts from 3 to 5 weeks;
- **Fourth stage:** Rotab this stage lasts two to four weeks and is often referred to as the date ripening stage.

- **Fifth stage:** Tmar This is the final stage of date maturation. The consistency of the fruit at this stage is comparable to that of grapes and plums. In most varieties, the skin adheres to the pulp and wrinkles as the pulp shrinks in size. However, in some cases, the very fragile skin cracks when the pulp shrinks, leaving fragments of sticky flesh exposed which attract insects or clump grains of sand. The color of the epidermis and pulp gradually darkens.

1.3. Biochemical composition of the edible part of the date

1.3.1. Major constituents

1.3.1.1. Water

According to Hasnaoui (2013), the water content in terms of quantity ranks second after sugars; it is an important and determining factor in the texture of the fruit; which has prompted several researchers to classify ripe dates according to their consistency into three categories: soft dates, semi-soft dates and dry dates. The water content varies with climatic conditions, the degree of maturity and depends on the varietal character.

1.3.1.2. Sugars

Sugars are the major constituents of dates, analyzes of date sugars essentially revealed the presence of three types of sugars: sucrose, glucose and fructose. This does not exclude the presence of other sugars in low proportions such as: galactose, xylose and sorbitol (Amellal, 2008) (Table 04).

Table 04: Sugar content of some Algerian varieties

Constituent relative to dry matter (%)	Soft date (Ghars)	Semi-soft date (Deglet-Nour)	Dried date (MechDegla)
Total sugars	85.28	71.37	80.07
Reducing sugars	80.68	22.81	20.00
Sucrose	04.37	46.11	51.40

1.3.1.3. Proteins and amino acids :

The date pulp contains only a small amount of protein. The rate differs according to the varieties and especially according to the stage of maturity, it is generally around 1.75% of the weight of the pulp. Also, it has been shown that the percentage of proteins present in the

nuclei of dates is greater than that of the pulp (Abou-Zeid and al., 1991). According to Al-Shahib and Marshall (2003), date proteins contain 23 amino acids (Table 08), some of which are not present in certain fruits such as bananas,

- **1.3.1.4. Organic acids Date**: juice is slightly acidic. Rygg (1948, 1953) reports that ripe dates are characterized by lower acidity with a pH of 5, but he does not formally comment on the role of acidity in dates. However, he puts forward the idea that high acidity is associated with poor quality. Youssef et al., (1992) analyzed two varieties of Egyptian dates and showed the existence of three organic acids: malate, citrate, and oxalate.
- **1.3.2. Biochemical composition of the non-edible part "Core"**

The core has 7 to 30% of the weight of the date. It is composed of a white, hard and horny albumen, protected by a cellulose envelope (Espiard, 2002). Table 6 reveals the biochemical composition of the nuclei of Iraqi dates.

Table 05: Biochemical composition of the seed of Iraqi dates (Munier, 1973)

Constituents	% content of
Water	6.46
Carbohydrates	62.51
Proteins	5.22
Lipids	5.22
Cellulose	16.20
Ashes	1.12

The general quality profile of dates involves an assessment of:

- Color, shape, size, taste, texture, kernel / pulp ratio and uniformity of color and size of the fruit;
- The chemical composition (acidity, water content, sugars, and other constituents if requested).
- The presence of blemishes, which may include discoloration, broken skin, sunburn, spots, deformities… etc.
- The presence of infestation by insects, foreign bodies, pesticide residues, molds and rots. The criteria for evaluating the quality of dates differ from country to country and from organization to organization. Among the latter we can cite:

- The criteria used according to the World Health Organization (Codex Stan 143- 1985)

2. The qualitative evaluation

criteria for dates of Algerian, Moroccan, Tunisian, Egyptian and Iraqi cultivars have been reported by Meligi and Sourial (1982) and Mohamed et al., (1983) cited by Hannachi et al., 2005 (Table 06).

Fruit length	**Reduced**	**<3.5 cm**	**Bad character**
	Medium	**3.5 – 4 cm**	**Acceptable**
	Long	**> 4 cm**	**Good character**
Fruit weight	**Low**	**<6 g**	**Bad character**
	Medium	**6 - 8 g**	**Acceptable**
	High	**> 8 g**	**Good character**
Weight of pulp	Low	**<5 g**	**Bad character**
	Medium	**5 - 7 g**	**Acceptable**
	High	**> 7 g**	**Good character**
Fruit diameter	Low	**<1.5 cm**	Bad character
	Medium	**1.5 - 1.8 cm**	Acceptable
	High	**> 1.8 cm**	Good character
Humidity	Low	**<10%**	Bad character
	Medium	**10 - 24%**	Acceptable
	High	**>24**	Good character
Total sugar	Low	**<50%**	Bad character
	Medium	60_70**%**	Acceptable
	High	**>70%**	Good character
character pH Acidic	Low	**<5.4**	Bad character
	Medium	**5.4 - 5.8**	Acceptable
	High	**> 5 , 8**	Good character

(Meligi et Sourial, 1982 et Mohamed et al., 1983)

Table 06: Qualitative evaluation criteria for dates.

2.1. Algerian quality assessment standards

According to the standards set by the Algerian Ministry of Agriculture in the interministerial decree of November 17, 1992 for known varieties: a date is said to be of acceptable physical and biochemical quality when the following criteria are met (Bousdira, 2007):

- No anomaly and not damaged.
- A date weight equal to or greater than 6 grams.
- A pulp weight equal to or greater than 5 grams.
- A length equal to or greater than 3.5 centimeters.

- A diameter equal to or greater than 1.5 centimeters.
- A pH equal to or greater than 5.4.
- Humidity between 10 - 30%.
- A sugar content equal to or greater than 65% of the dry weight.

PART TWO EXPERIMENTAL STUDY

Part II: Materiel and methods.

1.Objectives

The main objective of this work is the study of intra-clonal phenotypic variation in the cultivar Deglet Nour found in four different regions of the wilaya of Biskra, on the basis of morphological and chemical criteria of dates. We aim to verify and study the existence of a variation, within the same municipality and also between the different municipalities, expressed through the characteristics:

- **Morphological of fruits and pits.**
- **Chemical of dates.**

2. Geology and topography

2.1.Presentation of the study area

- **Tolga :** is a municipality in Biskra Province, Algeria. Located in south-east Algeria Tolga is well known internationally for high-quality dates (Deglet Nour). It has more than 500,000 date palm trees. Most dates produced are exported
- **Sidi okba**:

It is located about twenty kilometers from Biskra,. At the center of the oases, the city is surrounded by tens of thousands of palm trees. it is one of the meeting points between the Aures and the Ziban.

- **Ain naga** : town and municipality in north east Algeria
- **Bourdj Ben azouz**: located in the heart of the Ziban, a vast region planted with millions of date palms producing the best dates in the world and making the wealth of the wilaya of Biskra, Bordj Ben Azzouz is a municipality of the daïra of Tolga which is mainly phoenicultural.

Figure13: represents the area of work (wilaya of biskra).

3. Sampling

The study relates to the dates of the cultivar Deglet Nour.mech degla and degla bida . The dates are picked at full maturity (Tamr stage) from four regions of the Biskra willaya which are: ain naga(A). tolga (T). sidi okba (S). bordj ben azouz (B). from each region four different palm bunches were picked at random. The samples kept throughout the experimental period in paper bags in a cooler.

- 3 bunches per tree, from 3 different palm tree in each commune.
- 5 fruits from the branched part of each cluster, 3 from the top, 3 from the middle and 3 at the base 15 dates from each cluster.

3.1. Parameters studied

We studied 8 morphological parameters relating to fruits and pits and 6 biochemical parameters of dates.

3.1. 2.Analysis methods

Many analyzes were carried out in this study which are measures

morphological biometric, and other physiochemical (Figure 14).

3.1.3.**Biometric measurements.**

3.1.3.1 **Fruit weight**

The average weight of dates, pulps and stones is determined from weighing of 10 dates using an analytical balance

3.1.3.2.- Dimensions Measure

the length and average diameter in centimeters of dates, pulps, stones and carry out on 10 fruits chosen at random using a caliper

. - Pulp / date ratio the pulp / date ratio in percentage was determined by weighing the weight of 10 whole fruits and 10 fruits without seeds. For this, we used the following relationship:

Pulp / date ratio (%) = Weight of pulp / Weight of whole dates x 100 The pit/ date ratio in percentage was determined by weighing the weight of 10 whole fruits and 10 pits.

For this, we used the following relationship: pit / date ratio (%) = Weight of pits / Weight of whole dates x 100 The ratio stone / pulp in percentage was determined by weighing the weight of 10 fruits (pulp) and 10 pits.

For this, we used the following relationship: pits / pulp ratio (%) = Weight of pits / Weight of pulps x 100.

3.1.4.- Physicochemical analyzes

The dates are washed and stripped of their seeds. They are then cut very finely to

using a scissors, to which we add ten times its weight of distilled water, is brought to a water bath

at 60C for 30 minutes, with stirring. The extracted juice is filtered and the recovered filtrate will undergo

the rest physico-chemical analyzes.

All the measurements are carried out with 03 repetitions with a random sampling of dates.

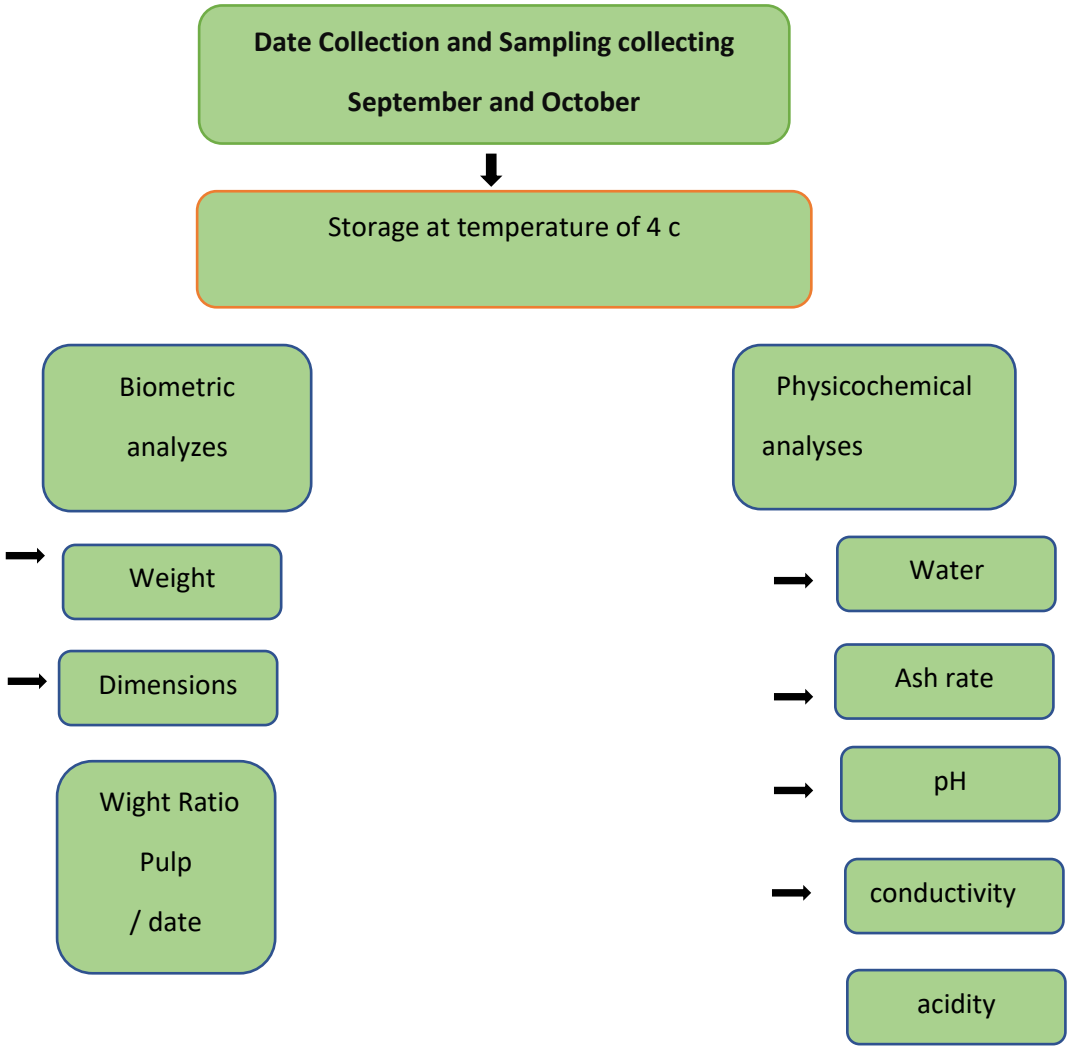


Figure14: the protocol followed.

Table07: abbreviations of parameters.

parameters	Abbreviations
Fruit length	FL
Fruit Width	Fw
Pit length	PL
Pit Width	Pw
Fruit Weight	FW
Pit Weight	PW
Soluble solid degree	SSD
Electric Conductivity	EC
Humidity	H %
Titratable acidity	TA
Ash content	AC

4. Morphological parameters:

The morphological parameters mainly concerned the weight, size and counting criteria of the date and its pit and were determined by the use of balance and calipers.

Balance | Caliper (pied a colisse) | Caliper (pied a colisse)

(original pictures)

Figure 15: instruments used for biometric analyzes

4.1. Physicochemical parameters

We performed the following analyzes:

pH, water content (H %), ash content (TC), S.S.D, titratable acidity (TA), conductivity EC.

4.1.1. Determination of pH (NF V05-108, 1970)

a. Principle

Determination in pH unit of the potential difference existing between two glass electrodes immersed in an aqueous solution of crushed date pulp.

b. Procedure

Place 20g of the prepared dough in a beaker and add 60ml of distilled water. Heat in a water bath at 60 ° C for 30 min, stirring occasionally; Grind, filter and carry out the determination using a pH meter at 20 ° C ± 2 ° C after calibration of the device.

Figure 15: Ph meter

(original pictures)

4.1.2. Determination of the water content (Audigie et al. 1978)

a. Principle

The water content is determined on an aliquot of 5 g of sample spread in a porcelain dish and then dried in an oven, at atmospheric pressure, at a temperature of 103 ± 2 ° C.

b. Operating procedure

Dry empty capsules in the oven for 15 minutes at 103 ± 2 ° C; Tare the capsules after cooling in a desiccator; Weigh into each capsule 5 g of sample to an accuracy ± 0.001 g, and place them in the oven set to 103 ± 2 ° C; Remove the capsules from the oven, place them in the desiccator, and after cooling, weigh them. The operation is repeated until a constant weight is

obtained (reducing the drying time to 30 minutes). The water content is equal to the loss of mass under the conditions of the measurement.

- Expression of results
- $$H\% = \frac{M1-M2}{P} \times 100$$

Either: H%: water content or humidity; M1: initial mass "before drying" "fresh material + capsule"; M2: final mass "after drying" "dry matter + capsule"; P: mass of the test portion.

Figure 16: date pulp after steaming.

(original pictures)

4.1.3. Determination of titratable acidity (NF V 05-101, 1974)

a. Preparation of the sample

Weigh to the nearest 0.01 g, 25 g of the prepared dough and place them in a flask with 50 ml of recently boiled and cooled distilled water, then mix well until a homogeneous liquid is obtained; Adapt a reflux condenser to the flask, then heat for 30 min; Cool, transfer the contents into a 250 ml volumetric flask and make up to the mark; Benchmark with recently boiled and cooled distilled water.

4.1.4. Volumetric titration

Take 100 ml of the test sample and pour it into a 250 ml beaker. Add 0.5 ml of phenolphthalein, and while stirring, pour the NaOH solution (0.1N) until a persistent pink color is obtained for 30 sd.

- Expression of results:

$$\frac{250}{m} \times \frac{V1}{10} \times \frac{100}{V0}$$

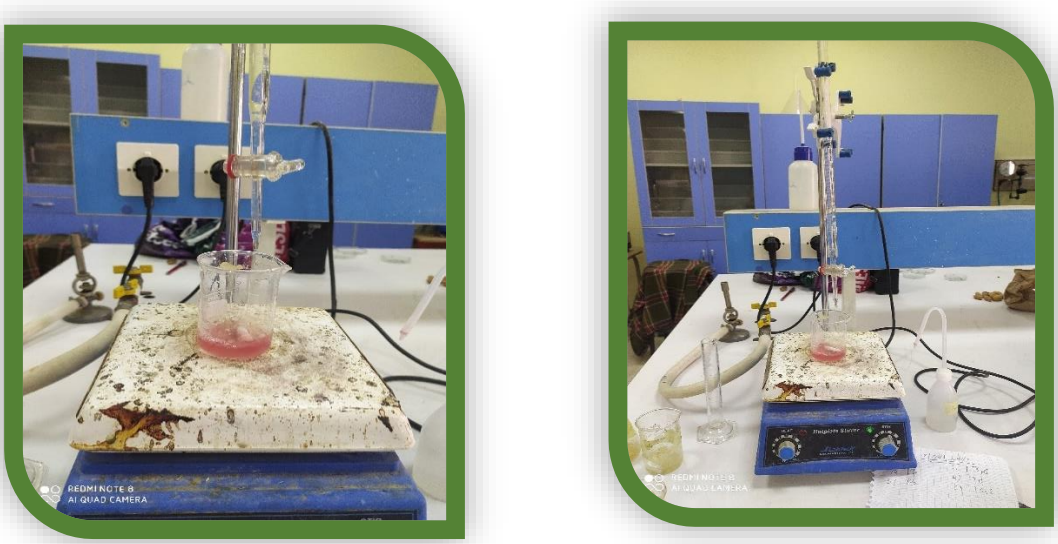


Figure 17: titratable acidity (color change)

(original pictures)

4.1.5. Determination of the total ash content (Linden, 1981)

a. Principle

The determination of the ash content is based on the destruction of all material organic under the effect of high temperature which is: 500 ° C

b. Mode of operation

Weigh 1 g of dry matter in a previously tared capsule; Repeat the operation 6 times for each variety of date; Put the capsules in the oven at a temperature of 500 ° C for 5 to 6 h; After cooling, remove the capsules and take their weights.

- Expression of results:

$$\text{Teneur en cendre} = \frac{(M2-M0)}{(M1-M0)} \times 100$$

Let: M0: mass of the empty capsule in g; M1: initial mass in g "capsule + dry matter" before incineration; M2: final mass in g "capsule + ash" after incineration.

Figure 18: muffle furnace.

(original pictures)

4.1.5. Determination of the SSD (Girard, 1965)

a. Principle

Measurement by refractometer, of the refractive index of a test solution at a temperature of 20 ° C. Then convert the refractive index into a soluble dry residue using a table, or read the dry soluble residue directly on the refractometer.

b. Procedure

Weigh 10 g of dates pitted and cut into small pieces which are added to twice its weight by volume of distilled water, 20 ml; After grinding and mixing in the mixer, we take a drop which we place on the refractometer which gives us a direct reading.

- Expression of results:
- The results multiplied in 3.

Note: The refractometer should be set to 0 with distilled water.

Figure 19: Refractometer

(original pictures)

4.1.6.- Determination of electrical conductivity

The electrical conductivity of dates expresses the mineral content of the product. She is expressed in mS / cm. The conductivity meter is calibrated with the 0.02% KCL of which the C.E is 2.4; then we determine the electrical conductivity of date juice (Dogar, 1980 in Bensetti, 2005).

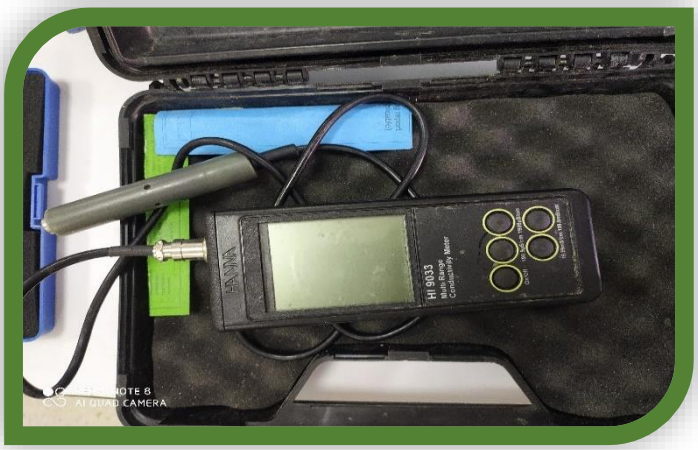


figure20: The conductivity meter

(original pictures)

4.2. Statistical data processing

For the processing of the data obtained, we used the software XLSTAT (2016) version 5.03. We performed a descriptive analysis of the data followed by an analysis of variance. The latter was carried out on two levels: within the same commune and between the study communes. Analysis of variance based on probability to estimate the significance rate of our results. We organized our results according to the probability value and the alpha threshold in classes:

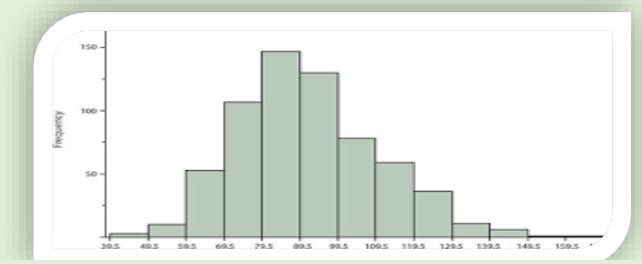
Class A: Pr 0.05, the variance of which is not significant (N.S)

Class B: Pr between 0.05 and 0.01, the variance of which is significant

Class C: Presence between 0.01 and 0.001, the variance of which is highly significant (H.S)

Class D: Pr <0.001, the variance of which is very highly significant (T.H.S).

CHAPITRE II: Results and discussion



1.Results

1.1 Descriptive analysis of the studied parameters

1.1.1 Minimum, maximum and average values

1.1.1.1 Morphological parameters

1.1.1.1.1 Weight criteria

a-Mech degla

in the figures we present the measured values of the weights and lengths of dates according to the four study regions.

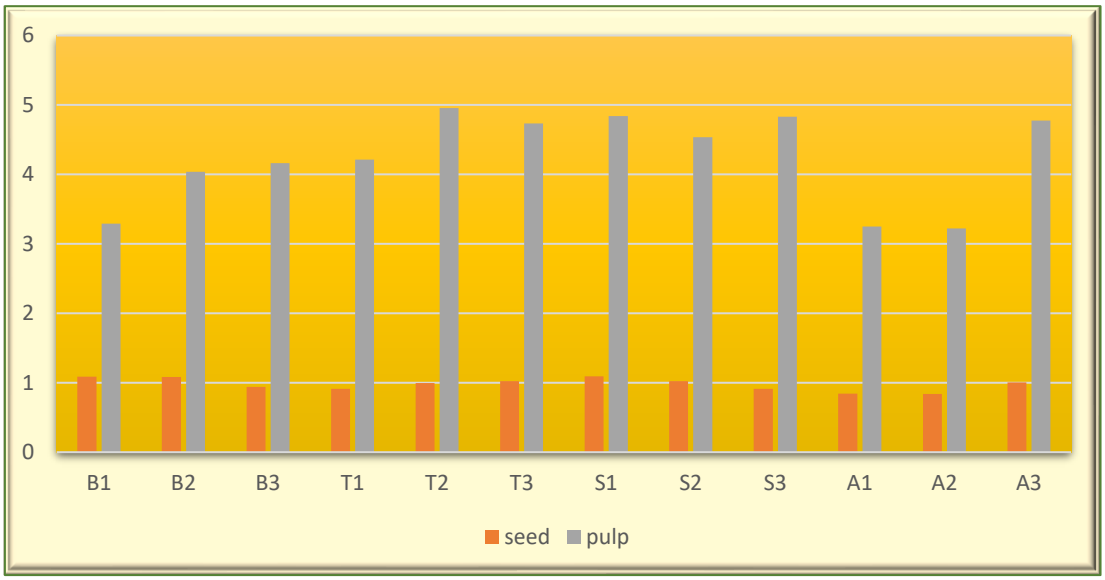


Figure 21: Weight of pulp and pits in the study municipalities in gr for the cultivar of Mech degla .

Bourdj ben azouz:

The weight of dates without pit is between 3.29 and 4.1646g with an average of 3.83g and the weight of the pit is between 0.91 and 1.086g with an average of 1.03g. Note that the fruits with the heaviest weight are those of the 3rd exploitation while the heaviest pit are of the dates of the first.

Tolga:

The weight of the date varied between 4.21 and 4.95g with an average of 4.63g and that of the pit between 0.91 and 1.02g with an average of 0.97g. This same figure also shows that the fruits with the most important weight criteria are those from farm No. 02.

sidi okba:

The weight values of the dates are between 4.53 and 4.84g with an average of 4.73 g and those of the pit between 0.91 and 1.098g with an average of 1.01g. This same figure also shows that the fruits with the most important weight criteria are found in farm No. 03 for the weight of the date and No. 01 for the weight of the pit.

Ain naga:

The weight fluctuated between 3.22 and 4.77 g with an average of 3.74g for the dates and between 0.83and 1.00 g with an average of 0.89 g for the pit the most important weights are those of the farm N ° 03 for the date and exploitation N ° 03. then for the pits the comparison of the measured values reveals that the tolga region contains the most important fruit weight and sidi okba has the most important pit weight.

B. Deglet nour

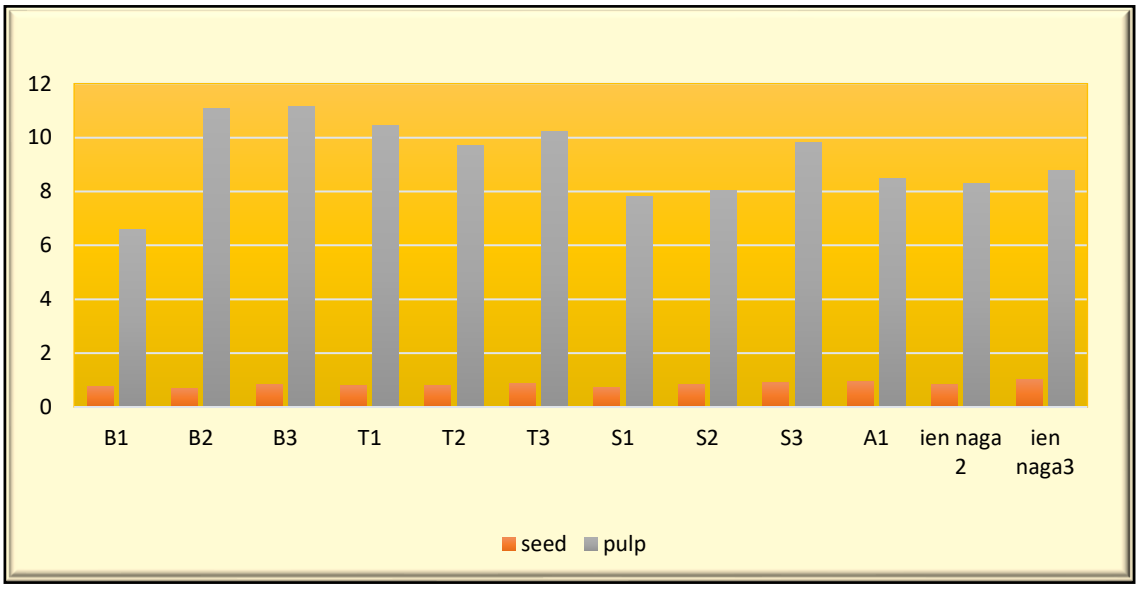


Figure 21: Weight of pulp and pits in the study municipalities in gr for the cultivar of (Deglat nour)

Bourdj ben azouz:

The weight of dates without pit is between 6.58 and 11.14 g with an average of 9.60g and that of the pit is between 0.69 and 0.84 g with an average of 0.76g. Note that the fruits with the heaviest weight are those from the 3rd holding, while the heaviest stone is that of the dates from the third as well.

Tolga:

The weight of the date varied between 9.71 and 10.4g with an average of 10.12g and that of the pit between 0.78and 0.88g with an average of 0.82g. This same figure also shows that the fruits with the most important weight criteria are those from farm No. 01.

sidi okba:

The weight values of the dates are between 7.82 and 9.81 g with an average of 8.56 g and those of the pit between 0.74 and 0.89g with an average of 0.82g. This same figure also shows that the fruits with the most important weight criteria are found in farm No. 03 for the weight of the date and No. 03 for the weight of the pits.

Ain naga:

The weight fluctuated between 8.28 and 8.78g with an average of 8.51 g for the dates and between 0.82 and 1.02g with an average of 0.92 g for the pit the most important weights are those of the farm N ° 02 for the date and exploitation N ° 03. then for the pit the comparison of the measured values reveals that the bourdj ben azouz region contains the most important fruit weight and ain naga has the most important pits weight.

C. Degla bida:

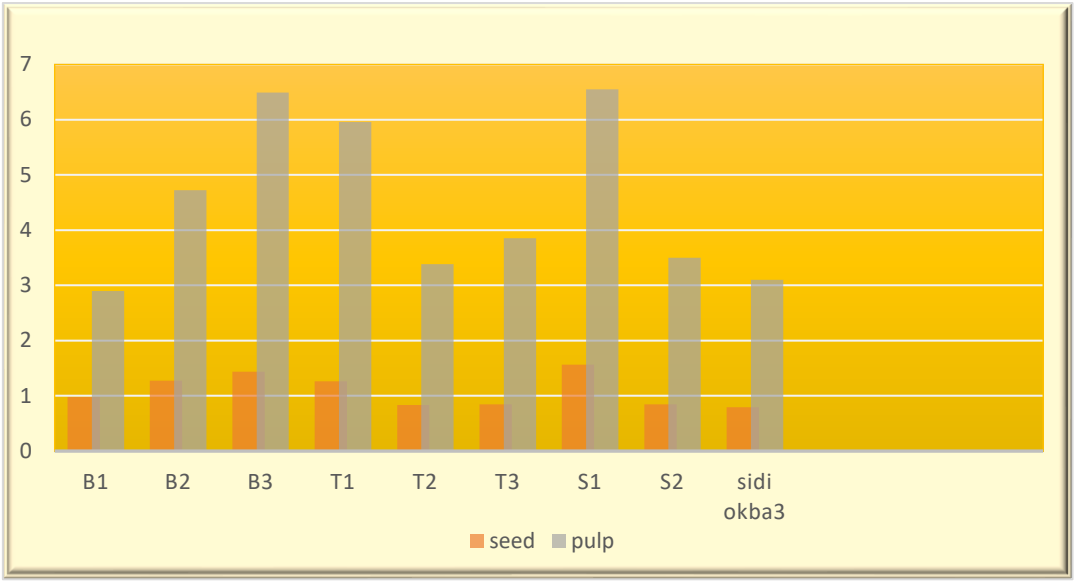


Figure 22: Weight of pulp and pits in the study municipalities in gr for the cultivar of Degla bida.

Bourdj ben azouz:

The weight of dates without pit is between 2.89 and 6.49 g with an average of 4.70g and that of the pit is between 0.98 and 1.43g with an average of 1.23g. Note that the fruits with the heaviest weight are those from the 3rd holding, while the heaviest pit is that of the dates from the third as well.

Tolga:

The weight of the date varied between 3.38 and g with an average of 4.40g and that of the pit between 0.83and 1.26g with an average of 0.98g. This same figure also shows that the fruits with the most important weight criteria are those from farm No. 01.

sidi okba:

The weight values of the dates are between 6.54 and 3.5 g with an average of 3.68 g and those of the pits between 0.79and 1.56 g with an average of 1.06g. This same figure also shows that the fruits with the most important weight criteria are found in farm No. 03 for the weight of the date and No. 03 for the weight of the pit. then for the pit the comparison of the measured values reveals that the bourdj ben azouz region contains the most important fruit weight and bourdj ben azouz has the most important pit weight.

1.1.1.2.Pulp/date ratio

The pulp content, expressed as a percentage by weight (Weight of the pulp / Weight of the date), indicates that the varieties of dates studied have percentages ranging from 81.1 to 90.9%. The variability can be explained by climatic conditions and the cultivation of dates. According to Munier (1973).

a.Mech degla:

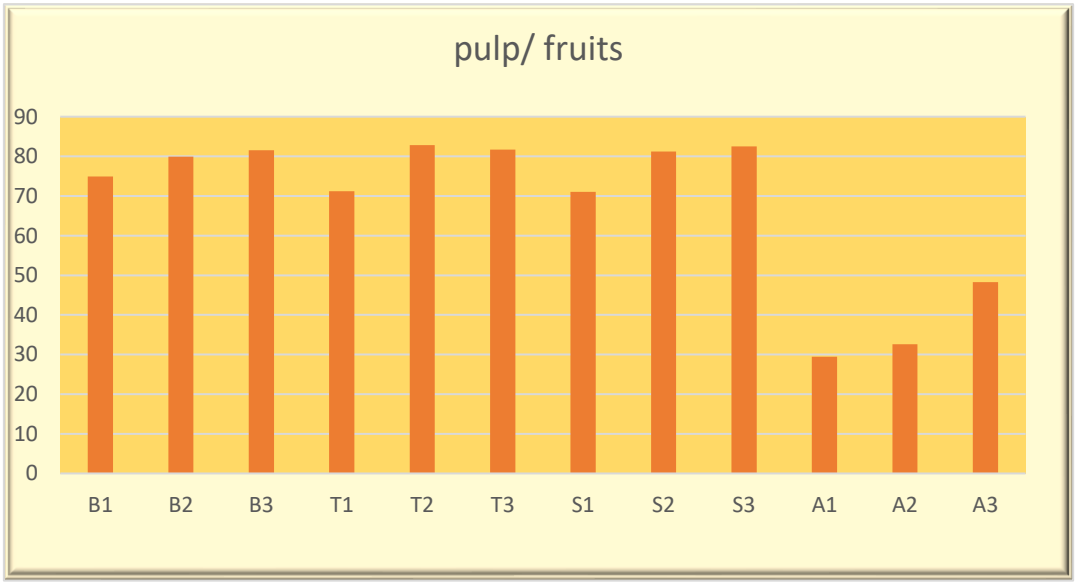


Figure23: the ratio pulp /date in the study municipalities for the cultivar of Mech degla.

Bordj ben azouz :

The ratio pulp/ fruit varied between 75 and 81 % with an average of 78 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 03.

Tolga:

The ratio varied between 70 and 82 % with an average of 77 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 02

Sidi okba:

The ratio varied between 71 and 81 % with an average of 77 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 03

Ain naga:

The ratio varied between 29 and 49 % with an average of 40 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 03

b. Deglat nour:

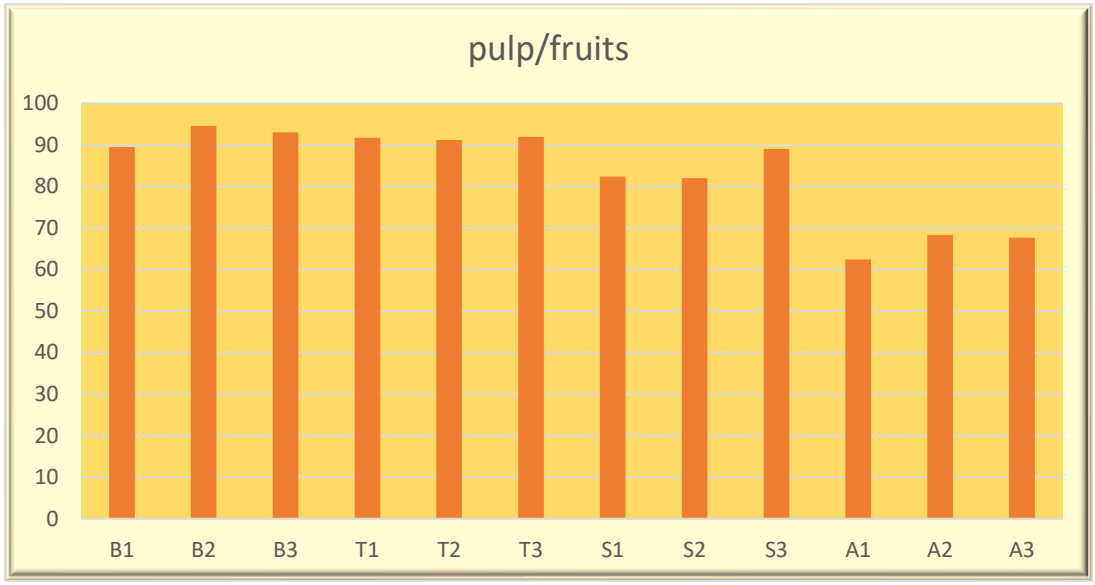


Figure24: the ratio pulp /date in the study municipalities for the cultivar of Deglat nour.

Bordj ben azouz:

The ratio varied between 89 and 94 % with an average of 92 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 02.

Tolga:

The ratio varied between 90 and 91 % with an average of 91 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 01

Sidi okba:

The ratio varied between 81 and 89 % with an average of 83 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 03

Ain naga:

The ratio varied between 61 and 69 % with an average of 66 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 02

c. Degla bida:

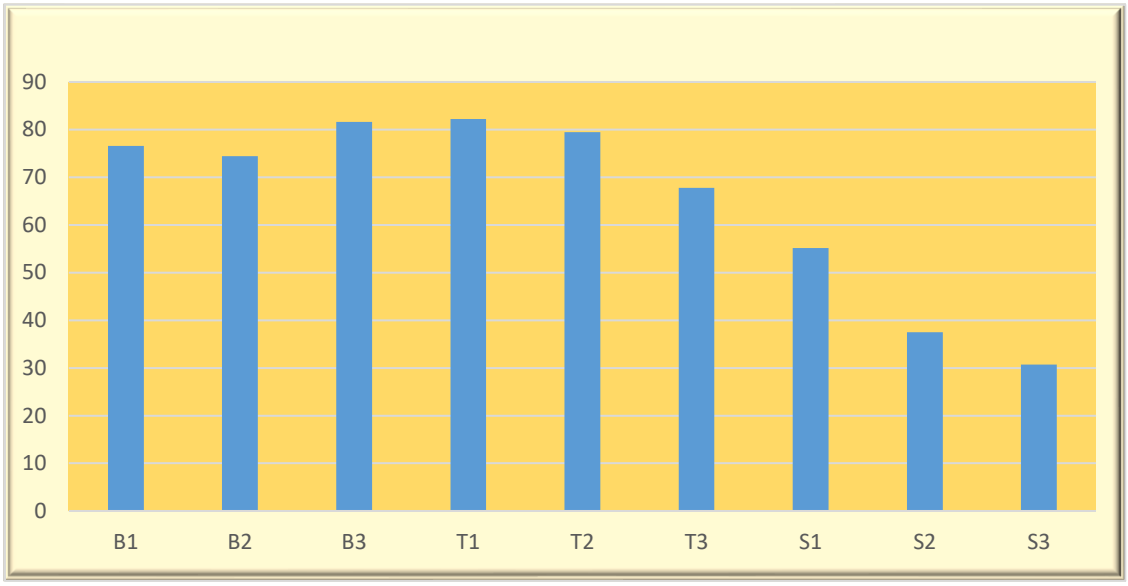


Figure25: the ratio pulp /date in the study municipalities for the cultivar of Degla bida.

Bordj ben azouz:

The ratio varied between 74 and 81 % with an average of 77 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 03.

Tolga:

The ratio varied between 67 and 82 % with an average of 76 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 01

Sidi okba:

The ratio varied between 30 and 55 % with an average of 41 %. This same figure also shows that the fruits with the most important ratio are those from farm No. 01

1.1.2.1. Dimensions:

a.Mech degla

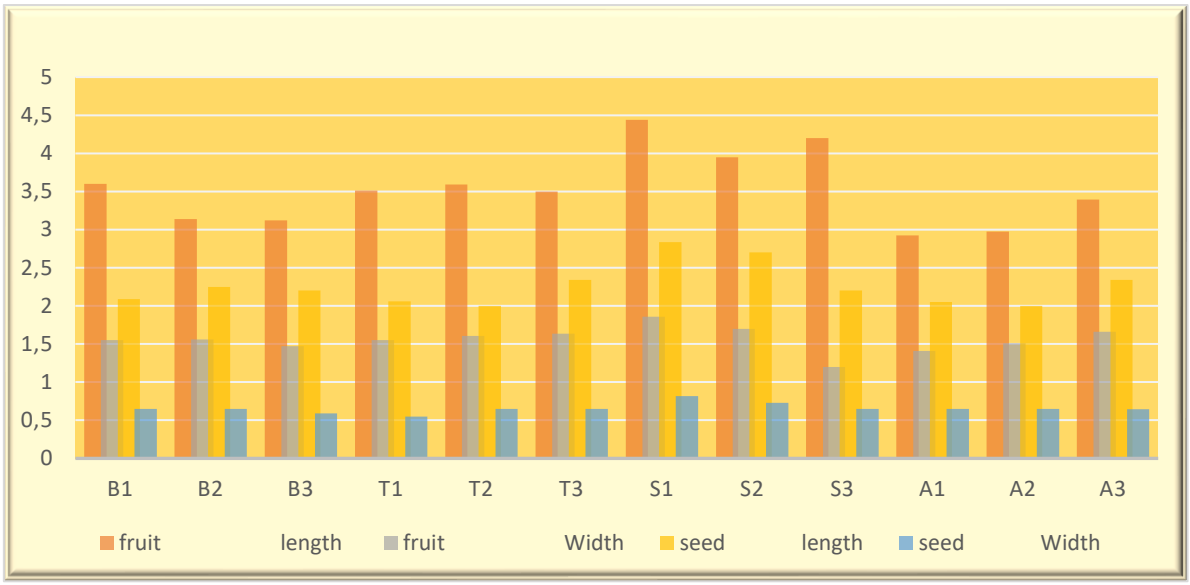


Figure 26: length and width of the dates and pits in the study municipalities for the cultivar Mech degla.

Bourdj ben azouz:

The lengths of the date are between 3.12 and 3.6 cm with an average of 3.28cm, those of the length of the pit between 2.25 and 2.09 cm with an average of 2.18cm. Regarding the widths of the date, they varied between 1.47 and 1.56 cm with an average of 1.526 cm. date pit width is between 0.59 and 0.65 cm with an average of 0.63 cm. This figure also shows that the fruits with the most important dimensions are those of the farm N ° 01 concerning the length and width. And run No. 02 concerning the denial of date pits.

Tolga:

With regard to the lengths of the date the values are between 3.5 and 3.59cm with an average of 3.533 cm. The lengths of the pits are between 2 and 2.34 cm with an average of 2.313 cm. The widths of the dates are between 1.55 and 1.635 cm with an average of 1.596 cm and the widths of the pits are between 0.55 cm and 0.65 cm with an average of 0.628 cm. The most voluminous dates are those from farm N ° 02 and farm N ° 03 concerning dementia of the pits of dates.

Sidi okba:

The date length values are between 4.44 and 3.95 cm with an average of 4.19 cm and the pits are between 2.2 cm and 2.83 cm with an average of 2.57 cm. The values for the width of the

date are between 1.2 cm and 1.85cm with an average of 1.585 cm and the width of the pits between 0.65cm and 0.81 cm with an average of 0.73 cm.

Ain naga:

The date length values are between 2.925 and 3.395 cm with an average of 3.098 cm and the pits are between 2 and 2.34 cm with an average of 2.13 cm. The values of the width of the dates are between 1.41 and 1.66 cm with an average of 1.526 cm and the width of the pits between 0.645 and 0.648 cm with an average of 0.64cm. This same figure also shows that the fruits having the dimensions the most important are those of exploitation N ° 03, concerning and the length of the date. The comparison of the values observed between the study regions shows that the dates in sidi okba have the length the most important dimensions concerning the length, the width of the fruit and the pits.

b. Deglet nour

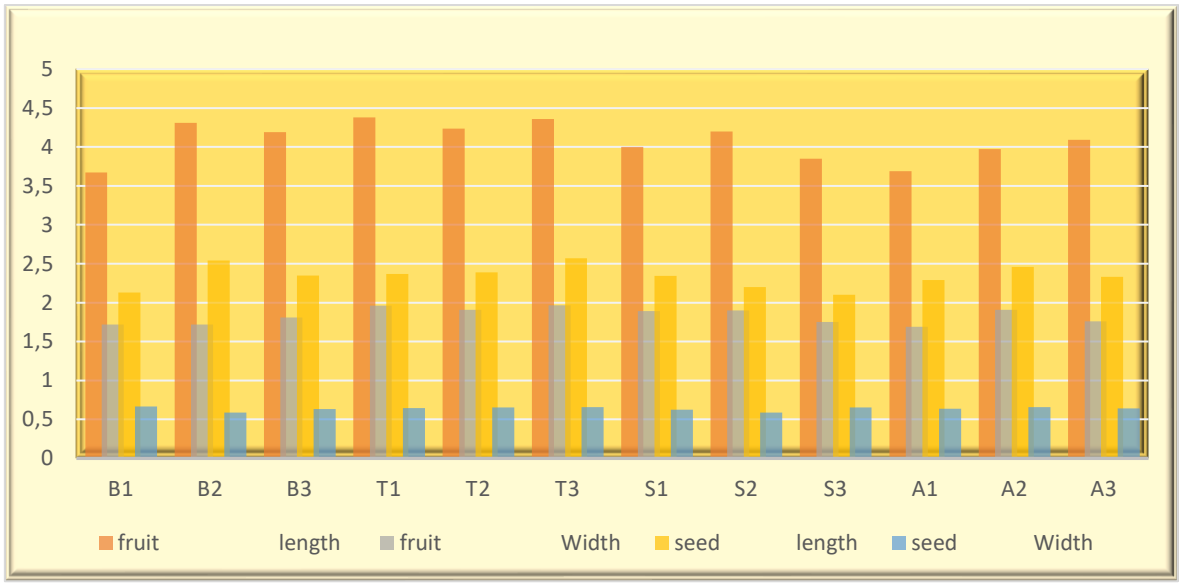


Figure27: length and width of the dates and pits in the study municipalities for the cultivar of Deglat nour.

Bourdj ben azouz:

The lengths of the date are between 3.67 and 4.31cm with an average of 4,057 cm, those of the length of the pits between 2.13 and 2.54 cm with an average of 2.34cm. Regarding the widths of the date, they varied between 1.72 and 1.81 cm with an average of 1.75cm. date pit width is between 0.59 and 0.665 cm with an average of 0.63cm. This figure also shows that

the fruits with the most important dimensions are those of farm No. 02 concerning the length of the dates and the pits. And operation N 03 concerning the denial of width.

Tolga:

Regarding the lengths of the date the values are between 4.235 and 4.38 cm with an average of 4.325 cm. The lengths of the pits are between 2.37 and 2.57 cm with an average of 2.44 cm. The widths of the dates are between 1.91 and 1.96 cm with an average of 1.945 cm and the widths of the pits are between 0.645 cm and 0.66 cm with an average of 0.653 cm. The most voluminous dates are those from the farm N ° 01 and the farm N ° 03 concerning the denials of the pits of dates.

Sidi okba:

The date length values are between 3.85 and 4.2 cm with an average of 4.01 cm and the pits are between 2.1 cm and 2.345 cm with an average of 2.215 cm. The values for the width of the date are between 1.75cm and 1.9 cm with an average of 1.847 cm and the width of the pits between 0.59 cm and 0.653 cm with an average of 0.622 cm.

Ain naga:

The date length values are between 3.69 and 4.09 cm with an average of 3.916 cm and the pits are between 2.29 and 2.46 cm with an average of 2.36 cm. The values for the width of the dates are between 1.69 and 1.91 cm with an average of 1.786 cm and the width of the pits between 0.638 and 0.66 cm with an average of 0.646 cm. This same figure also shows that the fruits having the dimensions the most important are those of exploitation N ° 03, concerning the length of the date. The comparison of the values observed between the study regions shows that the tolga dates have the length the most important dimensions concerning the length, the width of the fruit and of the pits.

c .Degla bida:

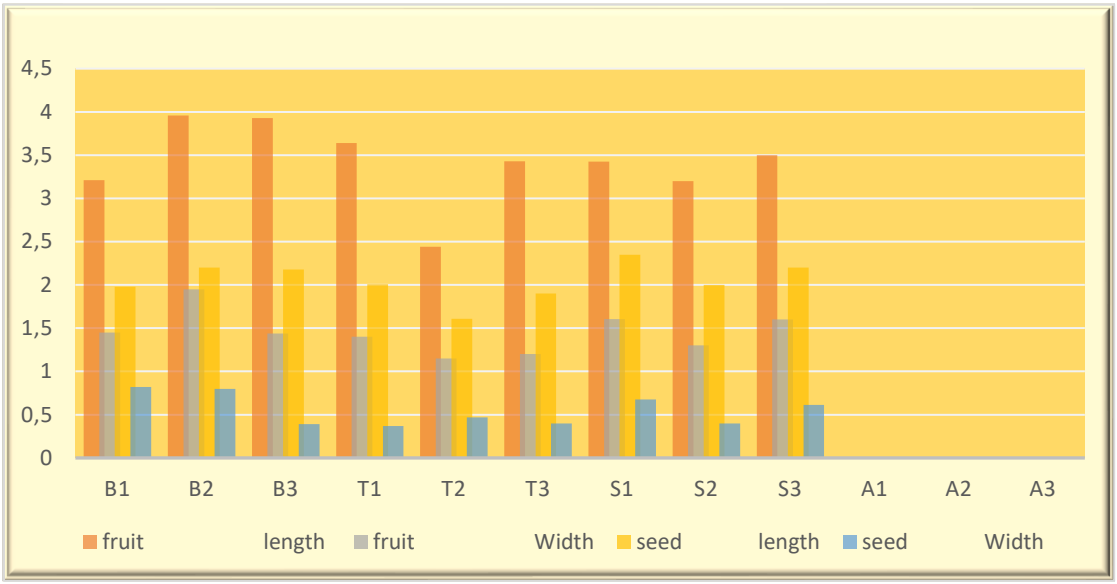


Figure28: length and width of the dates and pits in the study municipalities for the cultivar of Degla bida.

Bourdj ben azouz:

The lengths of the date are between 3.21 and 3.96cm with an average of 3.7 cm, those of the pits between 1.98 and 2.2 cm with an average of 2.12cm. Regarding the widths of the date, they varied between 1.44 and 1.95 cm with an average of 1.613 cm. stone width of dates are between 0.39 and 0.82 cm with an average of 0.67cm. This figure also shows that the fruits with the most important dimensions are those of farm No. 02 concerning the length of the dates and the pits. And exploit 02 regarding denial of pits width.

Tolga:

Regarding the lengths of the date, the values are between 2.44 and 3.64 cm with an average of 3.17 cm. The lengths of the cores are between 2.01 and 1.9 cm with an average of 1.83 cm. The widths of the dates are between 1.15 and 1.4 cm with an average of 1.25 cm and the width of the pits are between 0.37 cm and 0.47 cm with an average of 0.413 cm. This figure also shows that the fruits with the most important dimensions are those of farm No. 01 concerning the length of the dates and the pits. And run 02 regarding pits width denials.

Sidi okba:

The date length values are between 3.2 and 3.5 cm with an average of 3.375 cm and the pits are between 2.35cm and 2 cm with an average of 2.183 cm. The values of the width of the date are between 1.3cm and 1.605 cm with an average of 1.501 cm and the width of the pits between 04 cm and 0.677 cm with an average of 0.564 cm. This same figure also shows that the fruits with the most important dimensions are those of farm No. 01, concerning the length and width of dates and pits. The comparison of the values observed between the study regions shows that the dates with bourdj ben azouz have the length the most important dimensions concerning the length, the width of the fruit and of the pits.

1.2. Physiochemical analyses

1.2.1. Humidity (H%) and SSD

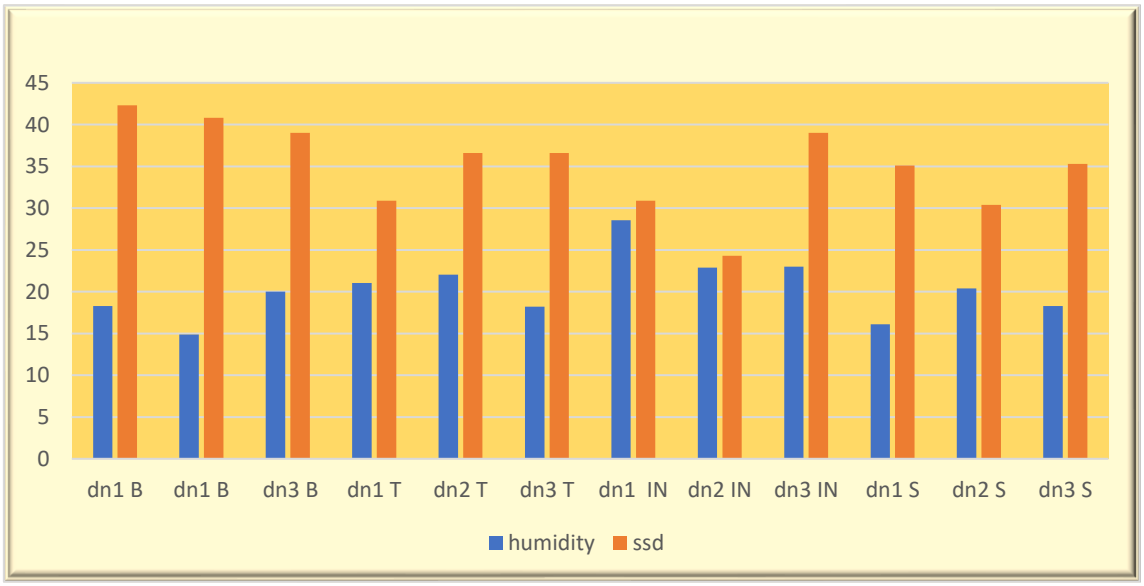


Figure 29: SSD and moisture content for the cultivar of Deglat nour:

varies from one farm to another; in the same region it is between:

- 14 and% 20 with an average of 18% in the Bordj ben azouz region.
- 18 and 22% with an average of 20% in the region of Tolga.
- 23 and 29% with an average of 25% in the region of Ain naga.
- 15 and 20% with an average of 17% in the region of Sidi okba.

Dates from the Ain naga region are the wettest with a humidity rate of 25% while Sidi okba has a lower rate of 17%. Regarding the values of the soluble solids content (SSD) of the dates studied, they were of the order of:

- 39 and 42% with an average of 40.7% in the Bordj ben azouz region.
- 31 and 37% with an average of 34.7% in the region of Tolga.
- 24 and 39% with an average of 31.4% in the Ain naga region
- 30 and 35% with an average of 33.3% in the region of Sidi okba.

Dates from the Bordj ben azouz region have the maximum value of the soluble solids content.

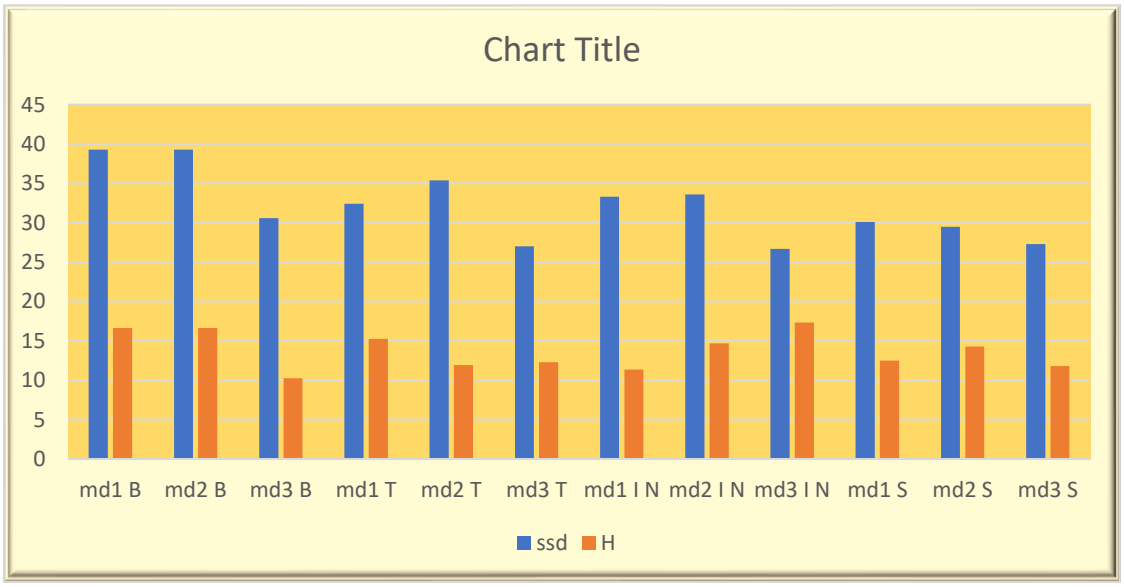


Figure 30: SSD and moisture content for the cultivar of Mech degla.

varies from one farm to another; in the same region it is between:

- 10 and% 17 with an average of 14.5% in the Bordj ben azouz region.
- 12 and 15% with an average of 13.2% in the region of Tolga.
- 11 and 17% with an average of 14.4% in the region of Ain naga.
- 12 and 14% with an average of 13% in the region of Sidi okba.

Dates from the Bordj ben azouz region are the wettest with a humidity rate of 14.5% while Sidi okba has a lower rate of 13.2%. Regarding the values of the soluble solids content (SSD) of the dates studied, they were of the order of:

- 30 and 39% with an average of 36.4% in the Bordj ben azouz region.
- 27 and 35% with an average of 31.6% in the region of Tolga.
- 26 and 34% with an average of 31.2% in the region of Ain naga.
- 27 and 30% with an average of 29% in the region of Sidi okba.

Dates from the bordj ben azouz region have the maximum value of the soluble solids content.

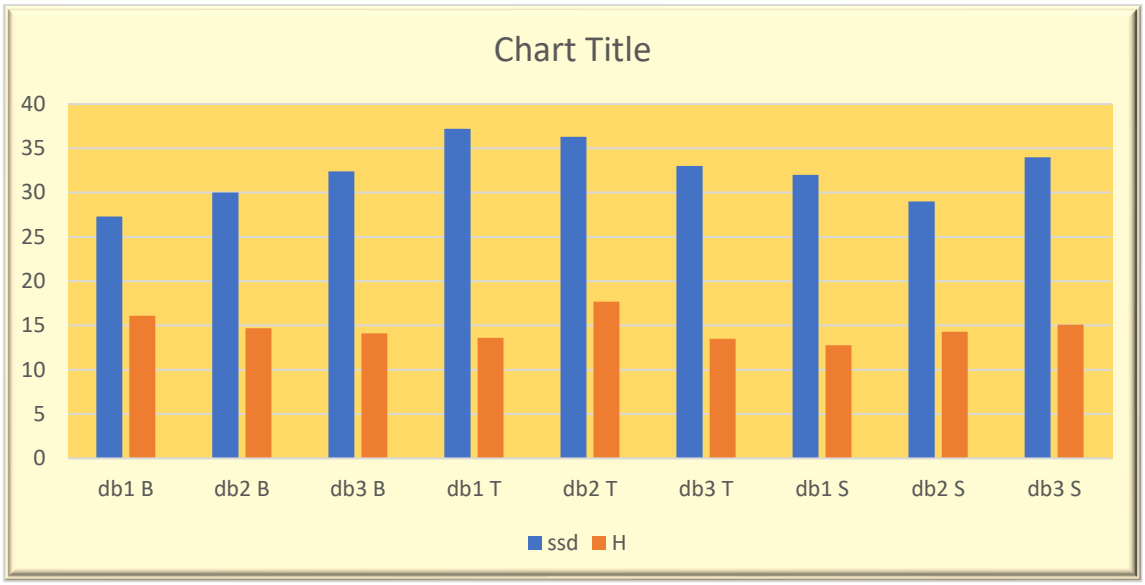


Figure 31: Degla bida date SSD and moisture content.

varies from one farm to another; in the same region it is between:

- 14 and% 16 with an average of 15% in the Bordj ben azouz region.
- 13 and 18% with an average of 14.9% in the region of Tolga.
- 12.7 and 15% with an average of 14.05% in the region of Sidi okba.

Dates from the Bordj ben azouz region are the wettest with a moisture content of 15% while Tolga has an almost identical rate of 14.9%. Regarding the values of the soluble solids content (SSD) of the dates studied, they were of the order of:

- 27 and 32% with an average of 36.4% in the Bordj ben azouz region.
- 33 and 37% with an average of 31.6% in the region of Tolga.
- 29 and 34% with an average of 31.66% in the region of Sidi okba.

Dates from the Tolga region have the maximum value of the soluble solids content.

1.2.2.pH and acidity

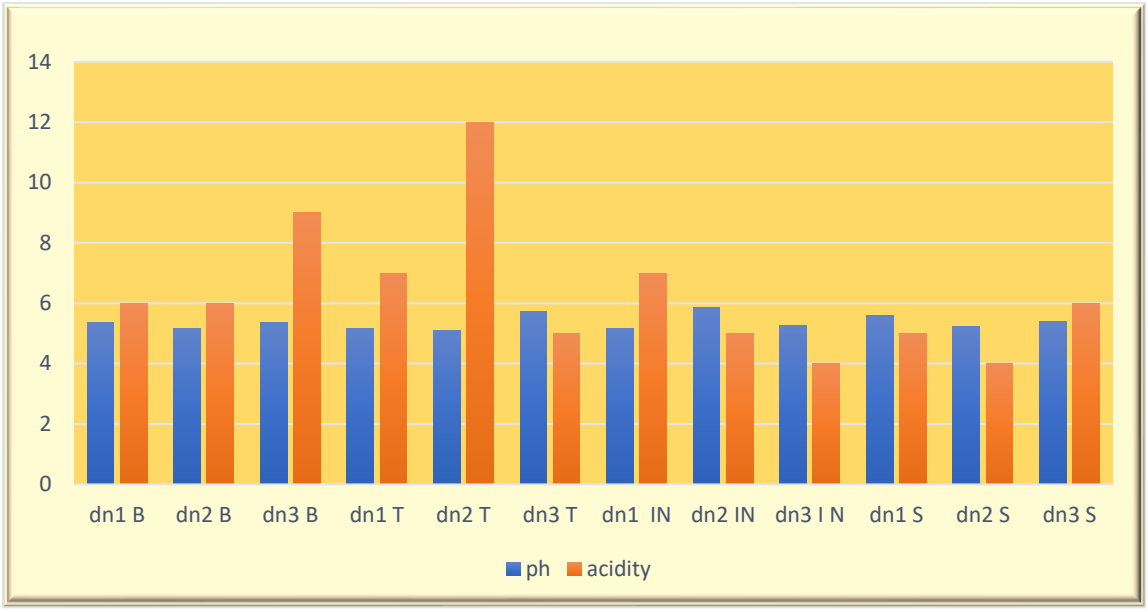


Figure 32: Deglat nour ph and acidity degree.

- Our results show that for all the dates sampled, the pH is slightly acidic, with an average varying between 5.3 and 5.43. Regarding the titratable acidity, the results at Bordj ben azouz vary from 6 to 9 meq / 100g and an average of 7 meq / 100g, a tolga differ from 5 to 12 meq / 100g and from an average of 8 meq / 100g , in naga range from 4 to 7 meq / 100g and an average of 5.33 meq / 100g. a Sidi okba different from 4 to6 meq / 100g and an average of 5 meq / 100g. Dates from Tolga have the highest value of the acidity rate (8 meq / 100g).

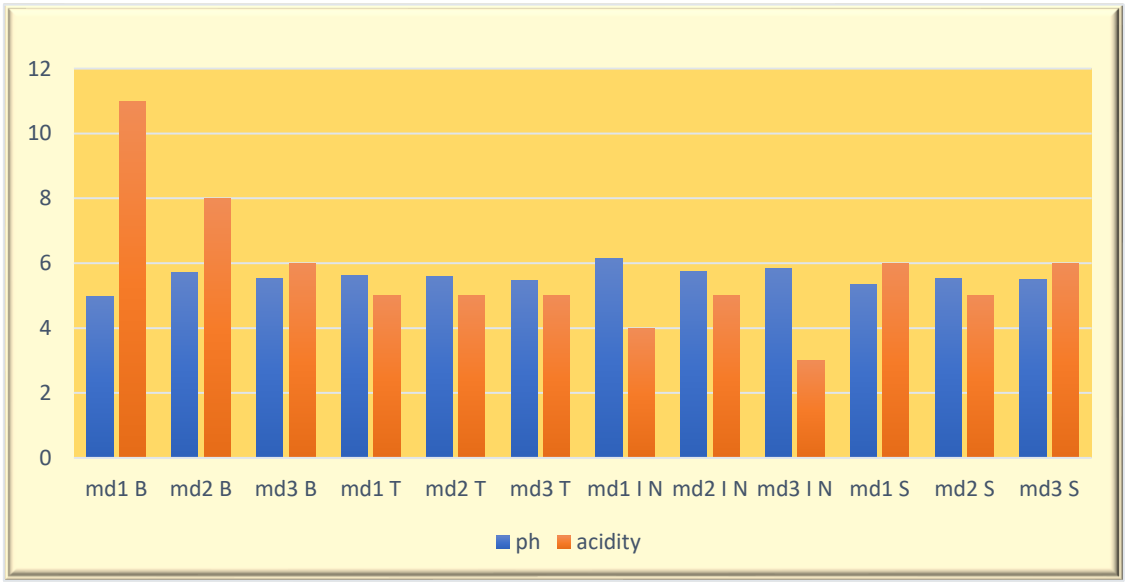


Figure 33: Mech degla ph and acidity degree.

- Our results show that for all the dates sampled, the pH is slightly acidic, with an average varying between 5.40 and 5.91. Regarding the titratable acidity, the results at Bordj ben azouz vary from 6 to 11 meq / 100g and an average of 8.33 meq / 100g, at Tolga with an average of 5 meq / 100g, at ein naga range from 3 to 5 meq / 100g and an average of 4 meq / 100g. A Sidi okba differs from 5 to 6 meq / 100g and an average of 5.33 meq / 100g. Dates from Bordj ben azouz have the highest value of acidity (8.33 meq / 100g).

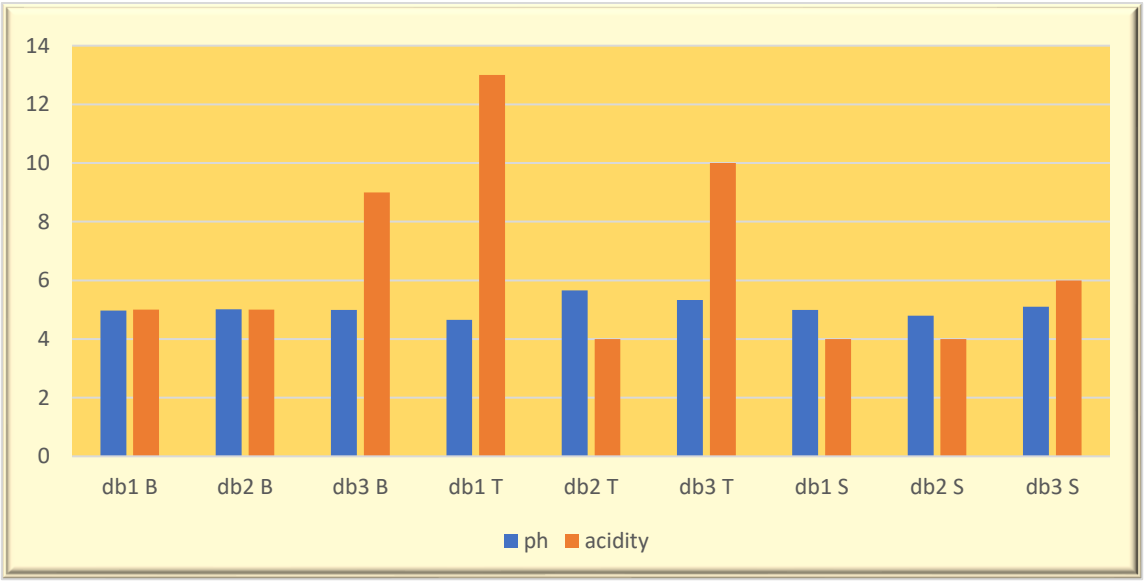


Figure 33:ph and acidity degree in the cultivar of Degla bida.

- Our results show that for all the dates sampled, the pH is slightly acidic, with an average varying between 4.99 and 5.21. Regarding the titratable acidity, the results at Bordj ben azouz vary from 5 to 9 meq / 100g and an average of 6.33 meq / 100g, a Tolga differ from 4 to 13 meq / 100g and from an average of 8.66 meq / 100g . A Sidi okba differed from 4 to 6 meq / 100g and from an average of 4.66meq / 100g. Dates from Tolga have the highest acidity value (8.66 meq / 100g).

1.2.3. Ash and conductivity

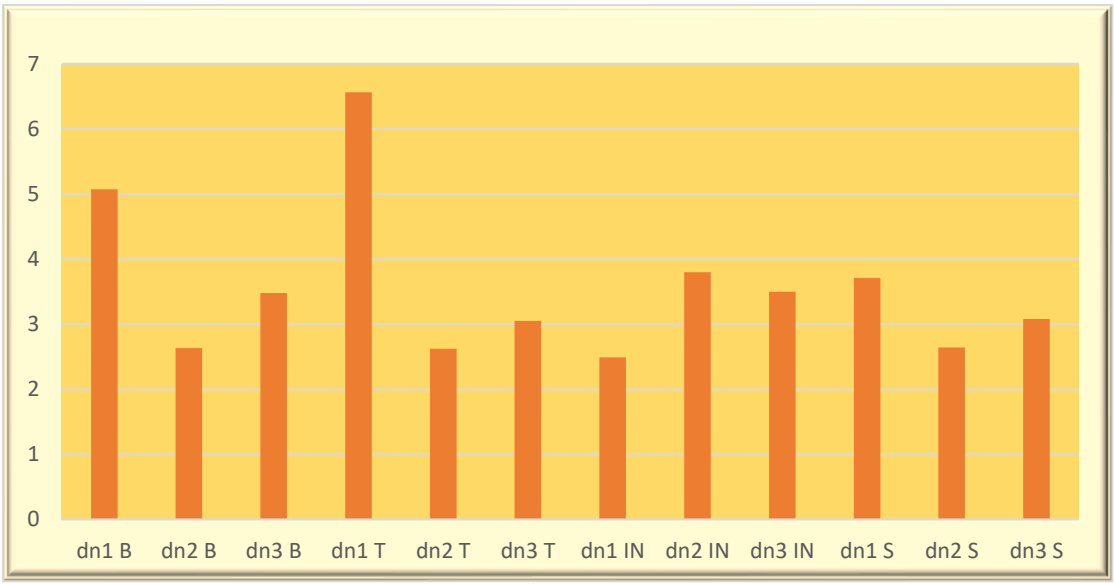


Figure 34: Ash content of dates in the four study regions the ash content represents for the variety of deglat nour.

the total amount of mineral salts presents in the sample. This is expressed as a percentage relative to the dry matter which is included, according to our results in figure 33, between:

- 2.63 and 5.07% in the Bordj ben azouz region and an average of 3.72%
- 2.62 and 6.56% in the region of Tolga and an average of 4.07%
- 2.49 and 3.8% in the Ain naga l region and an average of 3.26%.
- 2.64 and 3.71% in the Sidi Okba region with an average of 3.14%.

the region of ein naga represents the highest rate of the total quantity of mineral salts.

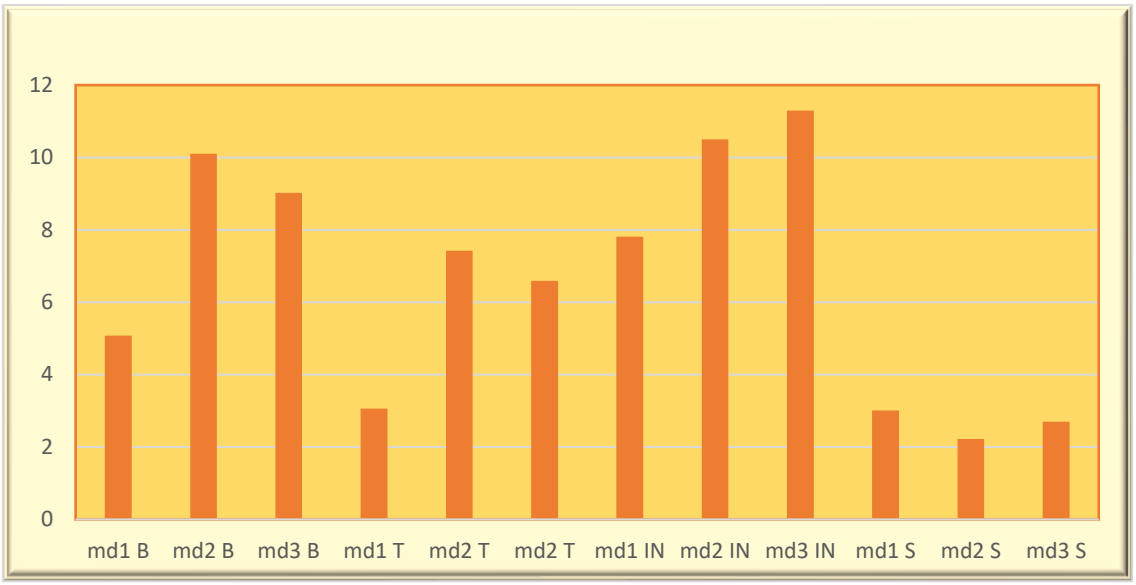


Figure35: Ash content of dates in the four study regions for the mech degla variety.

The ash content represents the total amount of mineral salts present in the sample. This is expressed as a percentage relative to the dry matter which is included, according to our results in the figure, between:

- 5.08 and 10.1% in the Bordj ben azouzet region with an average of 8.06%
- 3 and 7.42% in the region of Tolga and an average of 5.69%
- 7.81 and 11.3% in the Ain naga region and an average of 9.87%.
- 2.7 and 3.01% in the Sidi Okba region from an average of 2.64%.

the region of Ain naga represents the highest rate of the total quantity of mineral salts.

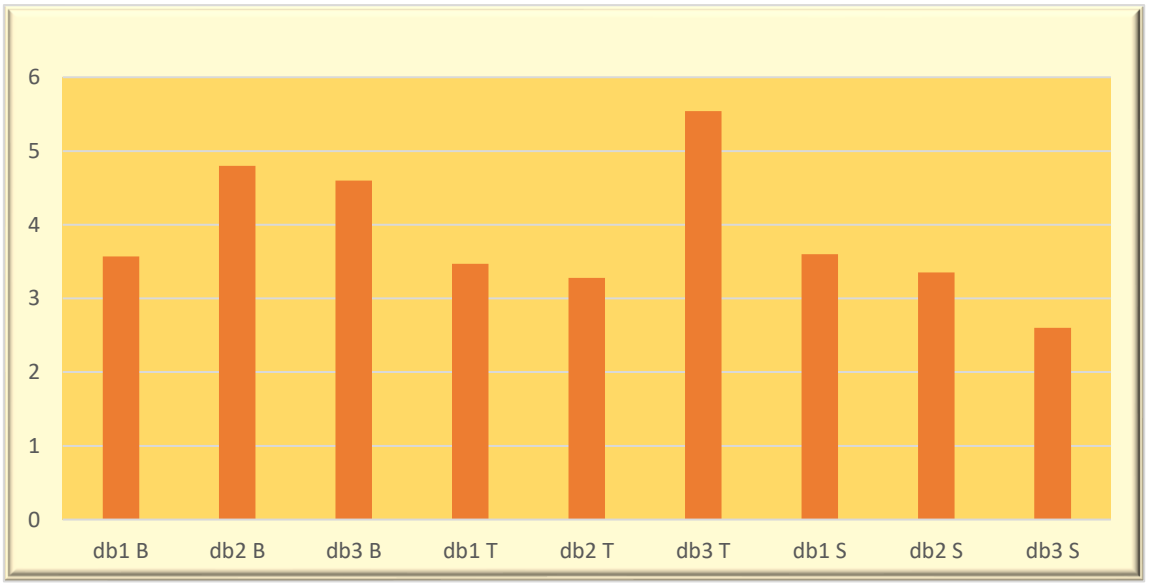


Figure36: Ash content of dates in the four study regions for the variety of degla bida.

The ash content represents the total amount of mineral salts present in the sample. This is expressed as a percentage relative to the dry matter which is included, according to our results in the figure, between:

- 3.57 and 4.8% in the Bordj ben azouz region and an average of 4.32%
- 3.28 and 5.54% in the region of Tolga and an average of 4.09%.
- 2.6 and 3.6% in the Sidi okba region from an average of 3.18%.

the bordj ben azouz region represents the highest rate of the total quantity of mineral salts.

1.2.4.Conductivity

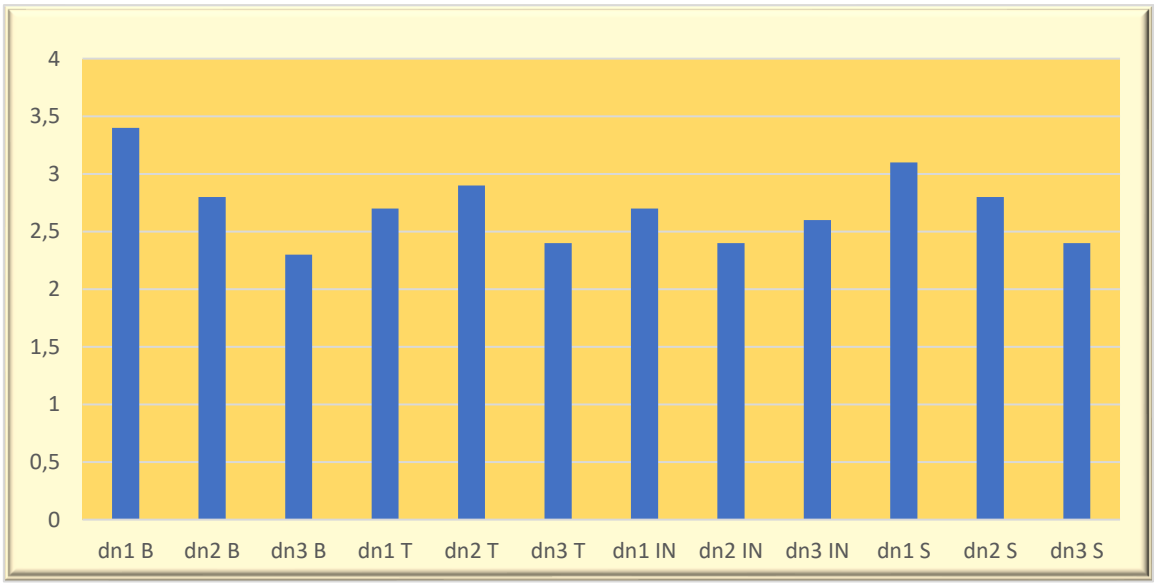


Figure 37: conductivity degree in the variety of deglat nour .

- Our results show that for all the dates sampled, the conductivity is varied between 2.3 and 3.4 mS Regarding bordj ben azouz with an average of 2.83 mS, a tolga differ from 2.4 to 2.9 mS and from an average of 2.66 mS. a sidi okba differ by 2.4 to 3.1 Ms and an average of 2.76 mS. for ien naga the average is 2.56 mS. Dates from bordj ben azouz have the highest value of conductivity.

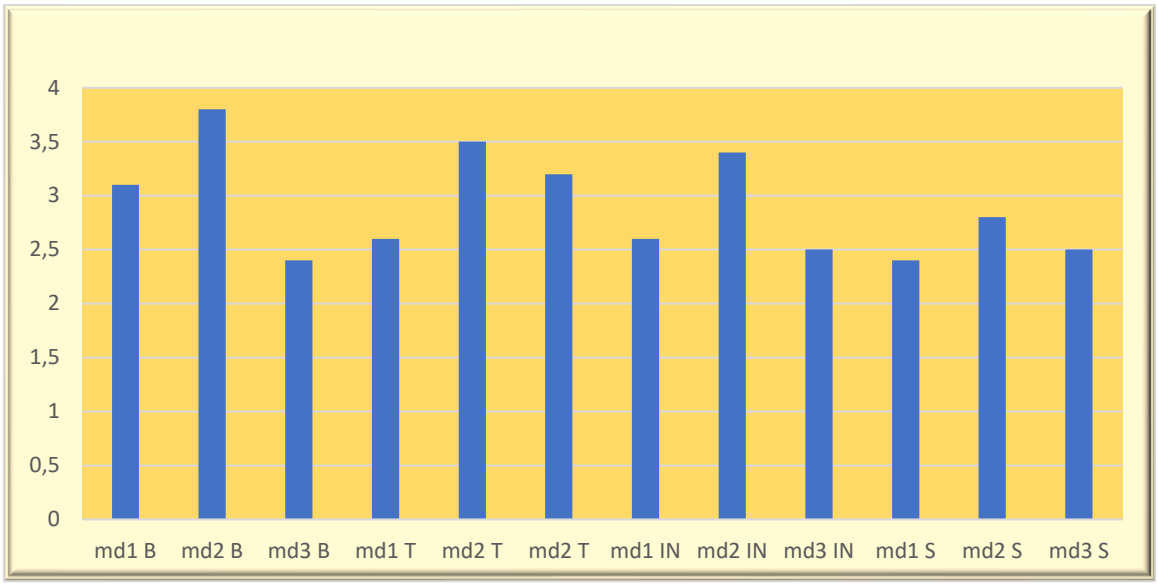


Figure 38: conductivity degree in the variety of mech degla.

- Our results show that for all the dates sampled, the conductivity is varied between 2.4 and 3.8mS Regarding bordj ben azouz from an average of 3.1 mS, a tolga differ from 2.6 to 3.5 mS and from an average of 3.1mS. a sidi okba differed from 2.4 to 2.8 mS and an average of 2.56 mS. for ien naga the average is 3.03 mS. Dates from bordj ben azouz have the highest value of conductivity.

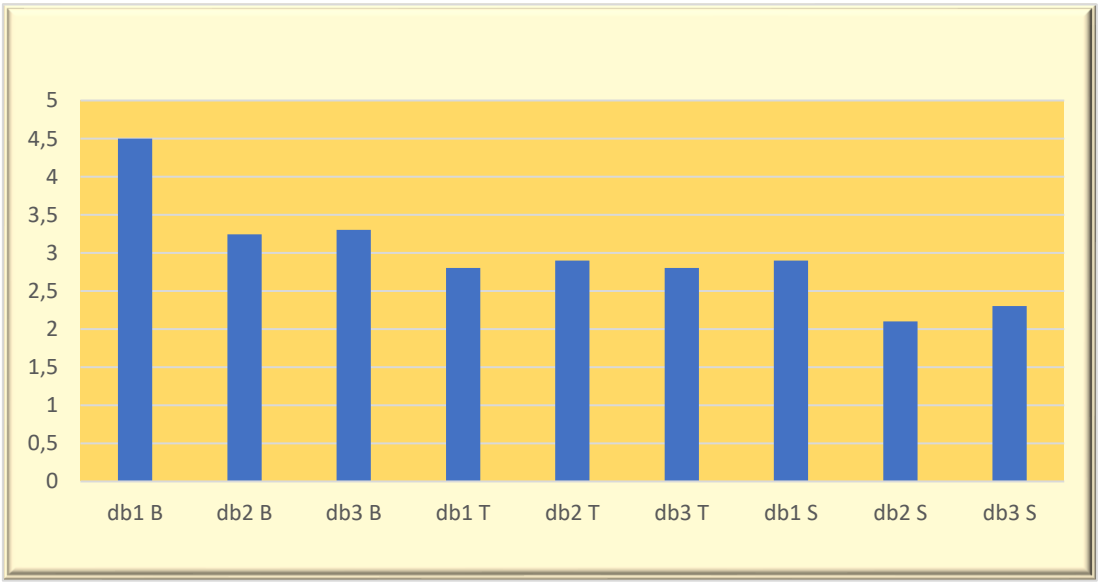


Figure 39: conductivity degree in the variety of degla bida.

- Our results show that for all the dates sampled, the conductivity is varied between 3.2 and 4.5 mS Concerning bordj ben azouz with an average of 3.66 mS, a tolga differ from 2.8 to 2.9 mS and from an average of 2.83 mS. a sidi okba differ from 2.1 to 2.9Ms and an average of 2.43 mS. Dates from bordj ben azouz have the highest value of conductivity.

2. Variance

The analysis of variance carried out on 8 dates per bunch for 4 cultivars gave very highly significant results for all the parameters relating to fruits and pits . To homogenize the statistical treatment, we considered the same number of repetitions per regime for all the parameters studied (3 repetitions).

Table 8: Expression of the variance revealed by the bio metric parameters for the variety of Mech degla.

Regions Parametre	Bordj ben azouz	tolga	Sidi okba	Ein naga	The four regions
FL	0,116001	0,006175	0,030833	0,056133	0,06036
S	**N.S**	**H.S**	**S**	**N.S**	**N.S**
Fw	0,0027	1,236419	0,007121	0,001233	0,281645
S	**H.S**	**N.S**	**H.S**	**H.S**	**N.S**
PL	0,0421	0,012133	0,015175	0,0112	0,021338
S	**S**	**S**	**S**	**S**	**S**
Pw	0,001425	0,140566	0,000994	0,000226	0,034222
S	**H.S**	**N.S**	**T.H.S**	**T.H.S**	**S**
FW	0,155714	0,0084	0,118633	0,440933	6,194015
S	**N.S**	**H.S**	**N.S**	**N.S**	**N.S**
PW	0,007185	0,003471	0,008457	0,015239	0,008155
S	**H.S**	**H.S**	**H.S**	**S**	**H.S**
pw	0,221418	0,144669	0,45509	0,757239	0,436076
S	**N.S**	**N.S**	**N.S**	**N.S**	**N.S**

Regarding the expression of the inter-municipal variation of the above parameters, the analysis showed an N.S variance for all the parameters except for the denial (length and width of pits) and even its weight where it was HS.

The results in the table reveal a variance: significant for the parameters pw.pl (width and length of pits) and highly significant variance for PW (weight of pits). Not significant for the rest of the parameter's cultivar.

Table 09: Expression of the variance revealed by the bio metric parameters for the variety of Deglat nour.

Regions Parametre	Bordj ben azouz	Tolga	Sidi okba	Ain naga	The four regions
FL	0,073733	0,002433	0,060033	0,06651	0,224959
S	N.S	H.S	N.S	N.S	N.S
Fw	0,002433	0,001858	0,117716	0,015833	0,026213
S	H.S	H.S	N.S	S	S
PL	0,0067	0,032933	0,111908	0,0337	0,072025
S	H.S	S	N.S	S	N.S
Pw	0,0012	0,003268	0,006808	0,062985	0,004255
S	H.S	H.S	H.S	N.S	H.S
FW	6,736933	0,133633	0,141633	0,530833	3,115964
S	N.S	N.S	N.S	N.S	N.S
PW	0,005304	0,002915	0,006264	0,010089	0,008052

S	H.S	H.S	H.S	S	S
pw	6,839185	0,137233	0,006264	0,062985	2,015105
S	N.S	N.S	H.S	N.S	N.S

a non-significant variation in the region of (Bordj ben azouz .Sidi okba.Ain naga) for the fruit languor parameter (fL)

A highly significant variation for the two regions Tolga and Bordj ben azouz in the both parameters wight and dimension for both pits and fruits and a significant variation for the region of Ain naga. Non-significant variation for the region Sidi okba for the fruit width parameter

Regarding the expression of the inter-municipal variation of the aforementioned parameters, the analysis showed an N.S variance for all the parameters except for the denial (fruit width) and pits weight. and even its width or it was HS.

The results in the table reveal a variance: significant for the parameters pW.pL (fruit width and pits weight) and highly significant variance for pw (pit width). Not significant for the rest of the parameters.

Table 10: Expression of the variance revealed by the bio metric parameters for the variety of deglat bida.

Regions **Parametre**	**Bordj ben azouz**	**tolga**	**Sidi okba**	**The four regions**
FL	0,1803	0,4107	0,024375	0,207413
S	N.S	N.S	S	N.S
Fw	0,085033	0,0175	0,030508	0,059237

S	N.S	S	S	N.S
PL	0,0148	0,0427	0,030833	0,047119
S	S	S	S	S
Pw	0,0589	0,002633	0,021133	0,033143
S	N.S	H.S	S	S
FW	4,425633	2,236433	1,696233	7,288919
S	N.S	N.S	N.S	N.S
PW	0,052789	0,060812	0,184097	0,086594
S	N.S	N.S	N.S	N.S
pw	3,229742	1,87988	3,554336	2,190459
S	N.S	N.S	N.S	N.S

Regarding the expression of the inter-municipal variation of the aforementioned parameters, the analysis showed an N.S variance for all the parameters except for the denials (width of languor of pits).

The results in the table reveal a variance: significant for the parameters pw. pL (width and length of pits) and Not significant for the rest of the parameters.

- **pysio_chemical parameters:**

The table below shows that the variability is not significant between the four regions for all parameters: Conductivity, titratable acidity, SSD. the pH. Ash.

Table11: Expression of the variance revealed by the pysio_chemical parameters for the variety of mech deglat.

Regions / Parametre	Bordj ben azouz	tolga	Sidi okba	Ain naga	The four regions
Ssd	0,2523	0,1812	0,1455	0,021733	0,190481
S	N.S	N.S	N.S	S	N.S
H	0,136107	0,033189	0,071501	0,016421	0,056099
S	N.S	S	N.S	S	N.S
Ph	0,146533	0,0063	0,0409	0,008633	0,13005
S	N.S	H.S	S	H.S	N.S
Acidity	2,583333	0	1	0,333333	4,839015
S	N.S	T.H.S	N.S	N.S	N.S
Conductivity	0,49	0,21	0,243333	0,043333	0,18
S	N.S	N.S	N.S	S	N.S
Ash	0,068547	0,053599	0,033427	0,001584	0,102814
S	N.S	N.S	S	H.S	N.S

- . The table below show that the variability is:
- not significant between the four regions for the parameters: Conductivity, titratable acidity, SSD. humidity.
- Highly significant for the ph.

- significant for the ash.

Table12: Expression of the variance revealed by the pysio_chemical parameters for the variety of deglat nour.

Regions Parametre	Bordj ben azouz	tolga	Sidi okba	Ain naga	The four regions
Ssd	0,0273	0,124033	0,5421	0,0769	0,269824
S	S	N.S	N.S	N.S	N.S
H	0,068401	0,039524	0,105306	0,046233	0,132306
S	N.S	S	N.S	S	N.S
Ph	0,0109	0,1153	0,132233	0,032433	0,0018
S	S	N.S	N.S	S	H.S
Ac dity	0,03	0,13	0,023333	0,01	0,051515
S	S	N.S	S	S	N.S
Conductivity	0,303333	0,063333	0,023333	0,123333	0,5
S	N.S	N.S	S	N.S	N.S
Ash	0,01534	0,046714	0,00471	0,002892	0,014182
S	S	S	H.S	H.S	S

- the next table shows that the variability is:
- not significant between the four regions for the parameters: Condictivity, titratable acidity, SSD. Ash.
- Highly significant for the ph.
- significant for humidity.

Table13: Expression of the variance revealed by the pysio_chemical parameters for the variety of deglat bida.

Regions Parametre	Bordj ben azouz	Tolga	Sidi okba	The 3 regions
Ssd	0,0651	0,0489	0,063333	0,105803
S	N.S	S	N.S	N.S
H	0,010533	0,057433	0,014016	0,022493
S	S	N.S	S	S
Ph	0,0004	0,265233	0,0247	0,00845
S	T.H.S	N.S	S	H.S
Acidity	5,333333	4,5	1,333333	0,5
S	N.S	N.S	N.S	N.S
Conductivity	0,503008	0,003333	0,173333	0.12
S	N.S	H.S	N.S	N.S
Ash	0,004356	0,015714	0,002708	0,47045
S	H.S	S	H.S	N.S

Discussion

The quantitative descriptive analysis related to the dates morphological parameters sampled from the region of Ziban of the morphological parameters of the dates subject of our study concerned the weight criteria namely Fw (fruit weight), Pw (stone weight) and certain biometric criteria relating to dates, stones and bunches. Our results are, overall, in agreement with others obtained by various authors on dates of the cultivar Deglet Nour, whose work was carried out in Algeria and other countries: (Noui et al., 2014) in the South East of Algeria; (Gourchala, 2015) in Adrar and Ghardaïa; (Saddouki and Salmi, 2017) in Ouargla; (Baraem Ismail et al, 2006) a UAE; (Abdel Moneim, 2012) in Sudan. They are, on the other hand, slightly lower than the results obtained, in different regions, by (Haroun, 2016) in Ghardaia; (Sayah and Mohamed Didi Ould El Hadj, 2010) in Ouaregla; (Elarem, et al, 2011) in Tunisia and (Hassnoui, 2013) in Morocco, (See table 20). Indeed, for the fruit weight (PF) parameter, the range of values we obtained corresponds to that found by Temami, (2018) a biskra and that of Saddouki and Salmi, (2017) in Ouargla. However, it is lower than that of the rest of the authors and higher than the values found by Naoui et al, (2014) (look at table 14).

Table 14: Comparison of some morphological results obtained with the results of other authors.

parametres / resultats	Study region	fw(g)	pw(g)	FL (mm)	pL(mm)	pW(mm)
Obtained results	Biskra	7.80_10.45	0.7_0.93	36-42.4	20-.24.66	5.9-6.4
Temami ,2018	Biskra	7,26-8,10	0,76-0,90	38-39,88	21,92-24,23	7,11-7,49
Noui and al, 2014	South East Algeria	6.63	0,74	37.07		
Haroun, et all 2016	Ghardaïa	9,95	0,91	43,1	27,8	
Gourchala Freha, 2015	Adrar and Ghardaïa	7,63	0,82	46		
Saddouki et Salmi ,2017	Ouargla	7,14-9,42	0,70-0,79	31,4-38,3	22-22,7	

Sayah Zineb and Mohamed Didi OULD EL HADJ, 2010	Ouargla	10,97	0,7	41,1	23,3	
El Arem Amira and al,2011	tunisia	0,49	0,99	41		
Hassnaoui ,2013	Maroco	10,104-11,548	0,875-1	41,33-42,66	20-21	7-8

The results obtained from the analysis of the physio-chemical parameters were similar to previous work as regards the pH which remains relatively lower than the pH value found by (el Arem et al, 2001) in Tunisia in Deglet dates. Nour. The range of water content we obtained was very wide (14-28%), with the maximum content observed in our sample (28%). The ash content is higher than that found by other works (Haroun Meriem and Khesrani Warda, 2016) and (Gourchala, 2015), (Noui et al, 2014).

Table 15: Comparison of some physio-chemical results obtained with other authors.

	Study regions	PH	Moister content %	ash %
Obtained results	**Biskra**	**5.18-5.8**	**14-28**	**2.49-5.17**
Temami.h 2018	**Biskra**	**5,5 to 6**	**13,25 to26**	**1,77 to 2,26**
Noui and al, 2014	South East Algeria	**05.30**	**09.59**	**02.50**
Haroun Meriem and Khesrani Warda,2016	**Ghardaïa**	**5,88**	**16,71**	**1,45**
Mme Gourchala Freha, 2015	**Adrar to Ghardaïa**	**6,08**	**22,46**	**1,64**
El Arem Amira and al, 2011	**Tunisia**	**6.85**	**21.95**	
Hassnaoui ,2013	**Maroc**		**10 to 24**	

The quantitative descriptive analysis of the morphological parameters of the dates object of our study concerned the weight criteria namely FW (fruit weight), Pw (stone weight) and certain biometric criteria relating to dates, stones.

Our results are, overall, in agreement with others obtained by various authors on dates of the cultivar Mech degla and Degla bida whose work was carried out in Algeria and in other countries:

The results obtained for the whole date and the seed weight are similar to the results of Chiban 2007 for both of the cultivars. the results for the length of fruits and fruits are also relatable. for the rest of the parameters obtained are inferior than Chiban's results.

Table17: The biometrical parameters for the cultivars of Degla bida and Mech degla marked by Chiban, H,2007.

Parameters	Mech-Degla	Degla-Beida
whole date weight (g)	6.16 ± 0.89	7.10±0.76
whole pulp weight(g)	5.10 ± 0.81	5.62±0.77
Weight of seed(g)	1.0601 ± 0.10 g	1.48±0.19
Length of date (cm)	3.588 ± 0.197	4.11±0.19
Width of date (cm)	1.905 ± 0.258	1.96±0.26
Length of seed(cm)	2.49 ± 0.12	2.6±0.15
Width of seed(cm)	0.809 ± 0.018	0.92±0.19
Pulp/whole date ratio (w/w) (%)	82.77	79.15

The results obtained from the analysis of the physio-chemical parameters were similar to previous work as regards the pH which remains relatively lower than the pH value found by (Noui ,2007) for Mech degla.and also similar to chiban's results. The range of water content we obtained is lower than the results of both authors, the ash content is higher than that found by the two other works .and for the other parameters (conductivity and acidity) they're both higher than Chiban's results.

Table 18: Comparison of some physio-chemical results obtained with other authors.

	Humidity	pH	Ash	Electric conductivity	acidity
Results obtained	13,75417	5,585	6,340842	2,9	5,958333
Noui Yassine 2007	**14.71**	**6.14**	**2.00**	**2.01**	**2.4**
Chiban ,H and all 2007	**14.77**	**5.54**			

The results of the morphological and chemical parameters obtained through the study that

we have shown an intra-clonal variation in both characters morphological and chemical .

the variation is important in both of them within the same municipality and between the four study municipalities. This

variation is due, in part to the relative extrinsic effects, on the one hand, to the environment , that they contain characteristics that diverge on several points and on the other hand,

practices followed by farmers. For example, the farm located in Tolga was located in a bed of wadi on a very rich relatively clayey soil and the palm trees were fine

maintained while in Ain naga the soil mostly contained sand and the palm trees were poorly cared for. Add the characteristics of the irrigation water which is softer and the different climate to tolga versus ain naga.

In this context, the work of Hasnaoui (2013) and Booij et al., (1992) highlighted evidence the influence of geographical origin on the content of dates in different components chemicals and thus consider that the latter cannot constitute reliable markers for varietal characterization in the date palm. Furthermore, they explain that this intra-clonal variation is due to the nature of the soils where the palm trees are grown, the composition of the irrigation water and the heterogeneity of the sampling.

Conclusion

Our work focused on the study of intra-clonal phenotypic variation in the following cultivars: Deglat nour, Mech degla and Degla bida based on the use of morphological and chemical markers. Here we present the most important results we obtained. Overall, all the morphological and chemical parameters involved in our study showed significant phenotypic variation within the same region as well as between the four study regions. The morphological criteria relating to the dates weights and dimensions have revealed a great variation in their values, both within the same municipality and between municipalities. From the results of the morphological parameters, we concluded that:

The Deglet nour dates with the heaviest weight and length fwere observed in Bordj ben Azouz. As for pits weight it's the region of Sidi okba; the analysis of variance revealed results which varied between non-significant and significant for all the morphological parameters relating to the fruits harvested from the different communes concerned by our study. This testifies to the existence of a significant intra-clonal variation in the cultivar.

Concerning the intra-clonal variation within the same commune, the results of the analysis of variance varied in the expression of their significance which was the most important in Sidi okba (HS) for the characters of the fruit namely the fruit weight (FW), fruit length (FL).This variation is expressed, also, through the classification of the quality index of the studied dates in two different classes: semi-soft (which is the ordinary class of Deglet Nour dates) and dry. Indeed, the latter case was observed in Ain Naga where the water problem penalizes farmers. On the other hand, the results of the descriptive analysis of the dates it showed a noticeable variation between parameters such as the acidity which is remarkably high in the region of Ain naga, analysis of variance of the chemical parameters also were highly significant for the pH, titratable acidity, SSD, not significant for the rest and this between the four municipalities.

For Mech degla dates, the variation was clear in most of morphological and chemical parameters also. we have find a noticeable deference in the length of dates between regions .we marked the longest dates in the region of Sidi okba and the heaviest in Tolga ,also The analysis of variance revealed results which varied between non and highly significant for all the morphological parameters. , the results of the analysis of variance varied in the expression of their significance which was most important in Ain naga (HS) for the fruit characters namely the fruit weight (FW), length of fruit (FL). The results indicate the existence of a significant intra-clonal variation in the cultivar object of this study.

Concerning the results of chemical components variance analysis of dates, the descriptive analysis revealed the existence of a significant variation in the values of the date samples studied. we have shown an intra-clonal morphological and chemical variation. This variation is due, in part to the relative extrinsic effects, on the one hand, to the environment. that they contain characteristics that diverge on several points and on the other hand, practices followed by farmers. For example, the farm located in Tolga was located in a valley on a very rich relatively clayey soil and the palm trees were fine maintained while in Ain naga the soil mostly contained sand and the palm trees were poorly cared for. the results of the analysis of variance of the chemical parameters were significant for electrical conductivity, titratable acidity, non-significant for the rest and this between the four municipalities.

The results obtained for Degla bida dates, showed the existence of significant intra-clonal variation. Concerning the morphological results the date with the highest and largest fruits are Ain naga ones and the heaviest are in Bourdj ben azouz and we noticed also that there is a remarkable variation within the same region and for the analysis of characters and chemical component, the results of the analysis showed that there is a deferent between all the parameter mesured in the 4 region and for the variance of chemical parameters ,they were highly significant for the titratable acidity and significant for SSD and ash, not significant for the remains and this between the four municipalities.

This variation is due, in part, to extrinsic factors like the environment or to the practices followed by farmers. Knowing the date palm's response to these factors makes possible the better management of the practices and even remedy to production defects in terms of quality and quantity. Our study must be followed by others to better understanding of the behavior of the date palm cultivars in different environments in the aim to select the most adapted or resistant ones and or establish a strategic breeding scheme to create new cultivars.

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Résumé :

L'Algérie est comptée parmi les plus importants pays producteurs de dattes dans le monde. Notre travail a porté sur l'étude de la variation intra-clonale du 3 cultivar dans quatre communes des Ziban : Tolga. Sidi okba. Ain naga. Bourdj ben azouz. Au total 8 paramètres morphologique et 6 chimiques des dattes et ont été analysés pour chuque variété (Deglet nour , Degla bida et Mech degla) . Les résultats obtenus ont révélé à une importante variation inter et intra-communale et ce pour tous les paramètres étudiés. Les résultats de l'analyse de la variance ont montré différents degrés de signification. Les paramètres morphologiques du fruit et quelques composants chimiques ont montré une variance hautement significative au sein de la même commune. Cette étude a également montré la grande influence de l'environnement à savoir les pratiques culturales suivi par les agriculteurs, le sol et l'eau d'irrigation sur la qualité des dattes.

Mot clefs : palmier dattier *(Phoenix dactylifera L.),* variation intra clonale, datte, régime, morphologie, composition chimique,Biskra

Abstract:

Algeria is one of the most important date producing countries in the world. Our work focused on the study of the intra-clonal variation of 3 cultivar in four communes of Ziban: tolga.sidi okba. Ain naga .bourdj ben azouz. A total of 8 morphological and 6 chemical parameters of dates and were analyzed for each cultivar (Deglet nour, Degla bida and Mech degla). The results obtained revealed a significant inter and intra-communal variation for all the parameters studied. The results of the analysis of variance showed varying degrees of significance. The morphological parameters of the fruit and some chemical components showed a highly significant variance within the same commune. This study also showed the great influence of the environment, namely the cultural practices followed by farmers, the soil and the irrigation water on the quality of dates.

Keywords: date palm (*Phoenix dactylifera L.)*, intra-clonal variation, date, Buch , morphology, chemical composition, Biskra

ملخص

تعتبر الجزائر من أهم الدول المنتجة للتمور في العالم. ركز عملنا على دراسة التباين داخل النسيلة لثلاثة أصناف في أربع مناطق من ولاية بسكرة و تتمثل في عين الناقة , برج بن عزوز , طولقة , سيدي عقبة , حيث تم تحليل 8 مقاييس ومورفولوجية و 6 كيميائية للتمور لكل صنف من الأصناف التالية (مش دقلة , دقلة بيضة ,دقلة نور) جيث أظهرت النتائج التي تم الحصول عليها وجود اختلاف داخلي في نفس المجتمع و في داخل الصنف حد ذاته لجميع المتغيرات المدروسة . كما أظهرت نتائج التحاليل تباين درجات متفاوتة من الأهمية للمتغبرات المورفولوجية للفاكهة و بعض المكونات الكيميائية تباينا داخليا عاليا داخل نفس الجماعة . كما أظهرت هذه الدراسة التأثير الكبير للبيئة و الممارسات الثقافية التي يتبعها المزارعون نوع التربة و المياه على جودة التمور .

الكلمات المفتاحية: نخيل التمر *(Phoenix dactylifera L.)* ، التشكل ، النظام الغذائي ، التمر ، الاختلاف داخل النسيلة ، التركيب الكيميائي ، بسكرة