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PERFORMANCE OF SOME AVOCADO CVS. UNDER DIFFERENT CLIMACTIC REGIONS IN EGYPT AND USE OF FRUIT OILS AS FAT REPLACE IN SOME FOOD PRODUCTS. 1. EFFECT OF CLIMACTIC CONDITIONS ON OIL CONTENT OF AVOCADO FUERTE AND HASS CVS.

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ABSTRACT:

This study was carried out to evaluate tree performance of "Fuerte" and "Hass" avocado cvs. under three different climatic conditions i.e. Shandaweel, Beni-Suef and El-Kanater, during 2014 and 2015, seasons.

The climate play an important role in flowering time, where is found the warmer climate promote oil contents than the coolest one, whereas the highest value of oil was achieved with warmer climate.

***Conclusively,** it can be concluded that achieving high content of oil, it should cultivate avocado under warm climatic conditions.*

Key words: Avocado, Fuerte, Hass cvs. climatic condition and oil content.

INTRODUCTION

Avocado *(Persea americana* Mill) is a tropical Native American fruit. It belongs to the Lauraceae family. It has been traditionally cultivated for food and medicinal purposes due to its high nutrition value as well as for its therapeutic properties. The genus *Persea* constitutes of 150 species out of which 70 are grown in the warmer regions of north central and South America. Its other entire species are cultivated in east and south East Asia (Ding *et al*, 2007).

Avocado is a tropical fruit and is considered as one of the most economically important fruit in Mexico with positive effects on human health (high content of high density lipoprotein, folic acid, potassium,

Vitamins A.B.C.D.E. and K). The high nutritional content and its dietetic properties made avocado one of the most attractive fruits to worldwide consumers (Ochoa *et al.*, 2009 and Saucedo-Carabez, 2015).

Avocado varieties need a climate without frost and with little wind. High winds reduce the humidity, dehydrate the flowers and affect pollination. The trees need well-aerated soils, ideally more than 1 m deep (Chen *et al.*, 2009). Commercial avocado cultivars are best suited to cool, subtropical conditions with average daily temperatures between 20 and 25^{o}C. Light frost can be tolerated, but not during flowering and fruit set (average to September). Average temperatures during flowering and fruit set should preferably be above 18^{o}c. The cultivars in increasingly order of sensitivity to cold temperatures are Edrano; Hass, Pinkerton, Fuerte and Ryan. For Fuerte and Hass cvs., the daily mean temperature during flowering should preferably be above 18.5 ^{o}C but definitely above 13 (Birbek, 2002).

In New Zealand (Requej- Topia, 1999) described Hass variety as being the most compatible with high quality oil extraction due to its large amount of flesh with a high oil content. Depending on the location of the orchard, the oil content of these fruit flesh can range from 16-17% in September to 25-30% in April depending on the fruit ripening stage.

Avocado fruit with high oil content must be used in the production of oil. Various factors, however, are known to affect the oil content such as cultivar, maturity stage, and location and growth conditions. There are some differences in oil content for the same cultivar due to different locations and growth conditions such as soil fertility. Sun exposed fruit were also found to yield higher levels of oil than those fruit in the shade (Arpaia *et al.*, 2006).

Therefore, this study aimed to evaluate the effect of different climacteric on some avocado cvs " Furte and Hass" oil contents.

MATERIALS AND METHODS

This study was carried out during 2014 and 2015, seasons on avocado trees of Fuerte and Hass cvs. grown under three different climatic regions i.e. El-Kanater (Horticulture research station) at Kalyobia Governorate, Sids (Horticulture Research Station) at Banisuef Governorate and Shandaweel region (Sohage Governorate) to evaluate the effect of different climatic conditions on tree fruit oil content.

Table 1. Mean of air temperature, humidity percentage and soil moisture content.

Regions	Air relative humidity (%)	Air temperature (◦C)	Soil moisture (%)	Soil pH	Plant age
Shandaweel	71	22-37	64.2	7.7-8.0	21
Beni-Swief	72	20-35	64.0	7.8-8.2	21
El-Khanater	87	18-33	70.1	7.6-7.9	21

The tested trees were 21-year-old at the beginning of study, planted in loamy soil and flood irrigated. Air relative humidity percentage, air temperature at °C, soil moisture content and soil pH were recorded (Table 1), during the two studied seasons. The chosen trees were grafted on avocado seedling rootstocks, planted at 7x7 m and subjected to the normal annual agricultural practices. For this investigation nine trees were chosen in each region divided into three replicates.

Statistical analysis*:*

Statistical analysis of the different collected data to variable significant differences were counted according to Steel and Torrie (1980). Individual comparisons were compared by the least significant differences (LSD) 0.05 according to Waller and Duncan (1969).

RESULTS AND DISCUSSION

The obtained results in (Table 2) clearly show that flowering starting early in fuerte and Hass avocado cvs. that are grown at Shandaweel region (25th and 23rd of December) for both cultivars, respectively, while trees at El-Kanater region began flowering later (15th and 17th of January) for both cvs, respectively, and trees grown under Beni-Suif condition began flowering on 1st January and 25th December. Flowering period extended from 24 to 30 days for trees under the different studied conditions, in both studied seasons, respectively.

The fruit oil contents varied between both cvs and locations under study, where the high fruit oil content was achieved at warmer locations. These results confirmed the finding of Reni *et al.*(2016); who revealed that flowering duration in avocado trees lasts from three to four weeks, whereas an avocado develops from an open flower into harvestable fruit in

approximately eight months. These results are in agreement with (Saucedo-Carabez*et al.*, 2015) who found that avocado contain from 5 to 40 % oil, the percentage varying with the variety, growing area and seasonal condition.

The monthly average of avocado oil extraction on a commercial scale by mean of the centrifugal process of whole Fuerte and Hass avocado (including pulp and peel) are listed in the Table 3.

As indicated in the above Table an oil recovery rate of 90 percentage may be achieved from avocados processed in September when the oil is more freely released from the cells. Oil content increased during the warm months gradually and for some unexpected reason the percentage of oil in the whole fruit reaches its peak in October, but the oil to be recovered has a tendency to decrease again slightly.

These results are in agreement with the finding of (Arpaia*et al*., 2006) who found that Sun exposed fruit were yield higher levels of oil than those fruit in the shade.

As the avocado fruit develops on the tree, the matured fruit shows, during senescence, a characteristic respiratory pattern known as climacteric. As the respiration rate rises and falls it is accompanied by a complex of other biochemical changes in the fruit mainly ripening of the fruit. In their ripening process the oil content of the fruit gradually increased and the moisture content decreases. The culled fruit picked at 8% oil level, is left by the oil processors to ripen at room temperature until it is fully soft.

Although, the oil content of the culled fruits may be 8 or 12%, it is most difficult to extract oil from the fruit by means of the centrifugal method. The reason for this may be that at this early stage the cell walls of the cells containing the oil, are still very thick and difficult to rupture. These oil cells are also bound together by pectic substances of the middle lamella and at this stage it is most difficult to disrupts the oil cells and break them up so as enable them to release the oil. The start of the ripening process to about fourth day, it was accompanied by a rapid decrease in protopectin and an increase in water soluble pectin. A decrease in the degree of esterifiction of the pectic substances. The binding or connecting substances of the oil cells (middle lamella), also contribute to the observed changes in the fruit texture. This process of de-estrification of the middle lamella loosens the cells from each other and at that stage the cell walls may also be more easily "ruptured", resulting in the release of the oil in the cells. As the season

Table 3. Average oil content in Fuerte and Hass avocado cvs from setting till harvest (seasons 2014 and 2015)

Months	Av. % oil in whole fruit		Av. Extracted oil (%)		Recovery	
	Fuerte	Hass	Fuerte	Hass	Fuerte	Hass
April	133	137	7.0	7.6	52.6	54.1
May	150	161	11.0	12.1	73.3	74.2
June	170	178	13.0	13.7	76.4	78.0
July	190	196	15.0	16.4	78.9	79.6
August	208	211	18.4	18.9	88.4	90.1
Sep.	201	208	18.5	20.4	92.0	94.6
October	242	244	20.3	22.3	83.8	84.4

progresses the oil content of the fruit also increases monthly, as the oil cells release the oil more rapidly (Table 3).

Conclusively, it can be concluded that achieving high content of oil, it should cultivate avocado under warm climatic conditions.

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نمو بعض اصناف الأفوكادو تحت ظروف ثلاث مناطق مختلفة فى مصر واستخدام زيت الأفوكادو كبديل للزيوت الاخرى فى بعض المنتجات الغذائية.

ا. تأثير الظروف المناخية على نسبة الزيت فى ثمار صنفى فيورت وهاس.

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نفذت هذه الدراسة لتقييم نمو وانتاج صنفى الافوكادو فيورت وهاس تحت ظروف ثلاث مناطق مختلفة فى مصر (شندويل بسوهاج ، محطة سدس ببنى سويف ومحطة بحوث القناطر بالقليوبية) خلال موسمى ٢٠١٤ ، ٢٠١٥ .

وجد من الدراسة أن المناخ يلعب دور مهم فى ميعاد التزهير حيث ان المناطق الدافئة كانت ابكر فى ميعاد التزهير كما ان الثمار الناتجة تحت ظروف هذه المناطق كانت نسبة الزيت فى ثمارها اعلى من المناطق الاقل فى درجة الحرارة.

التوصية: يمكن الحصول على ثمار افوكادو مرتفعة فى نسبة الزيت وكبيرة الحجم عند زراعتها فى مناطق اكثر دفئاً.