

Determination of the best time to harvest of *Origanum vulgare L.* cultivated locally for volatile oil production

Hala M. Musbah

Department of biology-, college of- science, Al Mustansiriyah-university, Baghdad, - Iraq

Email: hala.ghaith@yahoo.com

Abstract: A recent study has been conducted on the plant *Origanum vulgare L.* planted through the ecological condition in Baghdad city at the gardens located, the college of science, Baghdad University in jadria town to identify the best cultivated date of the plant to give a high level of essential oil during the year seasons. Significant differences have revealed that the rates of the oil extracted were different among the months of the whole year. It showed that autumn rather than in winter, in which growth is and summer, the plant grows well in spring, restricted. The highest rate of oil production was recorded in July, April and October Successively 2.16% ,1.97% ,1.8%. then in November 1.73% August 1.68% and March 1.2% After that, this rate had significantly decreased 0.2% in December and April. it is preferable to cultivate the crop three times yearly. Exactly in the mid of Consequently, July and October. April,

Key words: volatile oil, *Origanum vulgare L.*

1. INTRODUCTION

Origanum vulgare L. is one of the critical aromatic plants in medicine and treatment in ancient and modern times. It is one of the plants rich in volatile oils and has many nutritional, medical, and industrial benefits. It is called miracle oil[1]. This type of plant is characterized by being an aromatic herbal with a pungent smell similar to the smell of balsam. It reaches a vertical height with many branches.[2]. Its leaves are dark and coarse, arranged on the leg oppositely. They are almost oval and round and are carried on small petioles. The flowers are petite oval, from which fine white stamens come out. These flowers are gathered in the form of inflorescences in the leg, are yellowish-white in color, and are concentrated in the upper ends of the stem [3].

Its leaves are mainly used and harvested when they reach the highest oil level. It is preferable to use the plant when it is dried more than fresh [4]. *Origanum vulgare L.* was widely used in Italy, Greece and Mexico to give flavor and taste to many foods, but its use as a medicine dates back to the ancient Chinese and Greek civilizations. The Greeks used it to treat skin ulcers and relieve muscle spasms, while in China, it was used to relieve fever, stop Diarrhea and vomiting, and relieve jaundice and skin infections [5].

In the nineteenth century, American doctors used it as a general tonic and regulator of menstruation. Recently *Origanum vulgare L.* has been used to protect humans against

carcinogenic factors because of its ability to bind with the bonds in healthy human cells and its role in organizing cells and confronting cancerous cells [7]. Its use as an antioxidant agent because its volatile oil contains phenolic compounds [8].

Its oil has been used to treat infectious disorders and urinary tract problems and treat arthritis and asthma [9]. Its effect is almost equivalent to morphine, so this plant was used as an analgesic and a sedative for pain. In addition, it stimulates the secretion and flow of bile, which leads to the treatment of indigestion significantly [10].

It was on top of the list of plants used to treat patients with diabetes, as it was used in the treatment of low blood sugar [11]. It is also used in treating inflammation of the teeth or gums because the oil has sterile and antiseptic properties [12] and the treatment of muscle spasms and heart attacks [13].

Its cultivation has developed remarkably in America because of its nutritional and medical benefits and its aesthetic and psychological benefits. It has been successfully planted with its different colors and types in one place, making the place magical [14].

Because of the different quantities of oil extracted according to different plants and different seasons for one type of plant, it may be vestigial in some and high in others, affected by the climate and the nature of soil components and seasons and extraction methods [15]. In addition to the various genetic and environmental factors, many studies worldwide include studies on volatile oil production for this plant and the appropriate time. Unfortunately, we do not have data in Iraq about this plant to know the percentages of oil produced monthly and throughout the year.

The methods

1- Plant cultivation and diagnosis:

This study was conducted in the Department of Biology / College of Science - University of Baghdad (Al-Jadriya) botanical garden for the agricultural season 2004-2003. The land was plowed with a tilt plow in an orthogonal manner. The settlement and modification operations were conducted. The land was divided into two panels, each with 3 x 2.8 m. The service operations of irrigation, hoeing, and hoeing were carried out whenever needed. After that, the seedlings were planted in lines. The distance between the line and the other was 50 cm, and the distance between the plant and the other within one line was 40 cm. Thus, each panel included 30 seedlings. The planting date was 2004-12-20. The plant was classified by the professor of plant Taxonomy, Dr. Ali Al-Moussawi, in the department of biology/College of science/university of Baghdad, who confirmed the plant's name. He emphasized that species is the only available species of that genus in Iraq.

2- Preparation of the plant sample:

After beginning the plants' flowering, samples were taken to calculate the oil and estimate some nutrients and toxins. Then, the plants were washed well with tap water to remove dust and dirt covering the plant's surface and left a little to dry from the water, then isolated the leaves from the plant and the bracts with their flowers.

The sample was dried in an oven at a temperature of 35 °C to preserve its volatile oil for a period not exceeding 24 hours. The vegetative parts were manually crushed. The powder was kept in very clean and dry glass bottles away from light, heat, and moisture by using the hydro-distillation method by clavenger device [16]. (100) g of the dry powder of *Origanum vulgare L* was taken and placed in the glass beaker of the Clavenger device, 400 ml of distilled water was

added to start the extraction process, which lasted five hours. The oil was collected in an opaque package, wholly closed, and kept in a refrigerator at a degree (4-6) °C.

Statistical analysis

The results of the oil production experiment during the whole months of the year for *Origanum vulgare L* were statistically analyzed using a completely randomized design (C. R. D.) as mentioned [17]. The means were compared using the (L.S.D) least significant difference test and under the probability level of 0.05.

2. RESULTS AND DISCUSSION

It is clear from Figure (1) that the percentage of extracted oil varies with the months of the year. Furthermore, the highest percentage of oil was achieved in July, April, and October. It was 2.16%, 1.97%, and 1.81%, respectively. The percentage is significantly higher than achieved in the rest of the year. The lowest percentages were in January and February. The formation of volatile oil is related to environmental conditions, the nature of growth, and the plant's genetic factors [18].

In winter, the plant goes into hibernation and has low growth rates. Some formed oils may turn into alcohol as a resistance, not too low temperatures and freezing, as happens in many plants [19].

Therefore, we find that the percentage declines in December decrease more in January and February, and increase again in March, similar to what he obtained [20] in his study on the lemongrass plant.

When the plant began to resume vegetative growth and branching in March, the percentage increased to 1.22%. The percentage increased significantly in April to reach 1.97%, as plants reached their highest activities in vegetative growth in terms of many branches and an increase in the number of leaves and perhaps an increase in the percentage of chlorophyll (this Specific observations in the field). [21] indicated that the oil formed is associated with an increase in the leaf area, particularly with an increase in chlorophyll amounts due to the formation of oil in the chloroplasts.

Through distillation and calculating the percentage of oil in April, it was found that the produced oil is of a transparent color (pale yellow) with a fragrant and pleasant smell, and the speed of obtaining it by distillation compared to the rest of the months of the year. It takes longer during the rest of the year and indicates that the oil increases with the improvement of environmental conditions and moderation of temperatures. This is consistent with many studies that show that this stage represents the appropriate conditions for the growth of the *Origanum vulgare L*, which enters the role of cumin during the winter season. However, its growth increases little by little when the spring season begins, and the weather and environmental conditions improve [22]. It is also consistent with what he indicated [3] that the growing leaves and tops are very rich in active ingredients when the photosynthesis process reaches its highest stages of activity. This activity is achieved during the spring when the plant tends to form a sizeable vegetative group. By measuring the percentage of oil in May, it was found to decrease significantly to (0.16%) compared to the oil percentages in April and July for the plant to enter the flowering stage, as shown in Figure No. (3). Moreover, the fruits will be formed. Thus, the rates of the formed oil

decrease as most of the leaf components go to the flowers and fruits, which are the same results of what was found [23].

To analyze the variance of the productivity of volatile oil during the months of the year and then increase in July to increase the rates of vegetative growth and branching, where the highest percentage of oil was recorded (2.16%). With the flowering parts remaining, occupying the most significant part of the plant during June and somewhat less than the number of flowers during May, the oil percentage remains significantly lower than the other months' percentages. Whereas it did not reach the level of assurance with May, as shown in Table (2). The extract increased with the plant's age in each patch than before. Although the percentage of oil reached its highest levels in the summer, it did not enjoy those specifications obtained during the spring.

It was noted that the extracted volatile oil was not transparent at this stage as it was in the spring due to the formation of certain substances that may be ketones. However, It was observed that a layer of white waxy color was formed on top of the extracted oil layer, distinguished by its pale yellow color. In addition, the pleasant smell was not as distinct as that obtained in the spring. The oil percentage remains between (2.16%) during July and (1.68%) during August. It decreases again significantly in September to reach (0.8%) and then rises again with early autumn and from 10/15 to record a significant difference of (1.81%). This percentage remains almost intact during November, reaching 1.73%.

With the change of climate and the onset of winter, the percentage drops again during the date of harvest, which took place in the middle of December and the period 2/15. When the oil percentage reaches (1.04%), and with the increase in cold and rain, and for the period from 12/30 to the end of February, the percentage of oil decreases significantly decreased up to (0.2%). These results are consistent with his findings [22] in Australia, who confirmed in his study that the percentage of oil decreased significantly in the cold seasons compared to the seasons in which the temperature is high, as the plants go through the period of latency. It emphasized the necessity of weeding the plant before the period of frost, freezing, and rain, about (4-6) weeks from the start of this stage.

It is worth noting that the percentage of extracted volatile oil was equivalent to some percentages extracted globally, especially concerning the Mexican type with high productivity. It ranged between (1-5% Katzer, 2000)) which is close to the type studied, whose ratio ranges between ((0.2-2.16%, which is much better than the percentages of the volatile oil yield of the Egyptian the *Origanum vulgare L*, whose ratio ranges between (0.3-0.4%), at its best reaches 1% in the case of a good fertilization program [3].

It was also better than the Lebanese type O.Syriacum and the Greek type O.Vulgarae, in which the highest percentage reached (0.5% Ravid et al.,1996)). Table (3) shows the average values of volatile oil production in the months of the year. In contrast, Table (2) indicates the statistical analysis results to analyze the variance of volatile oil production during the months of the year.

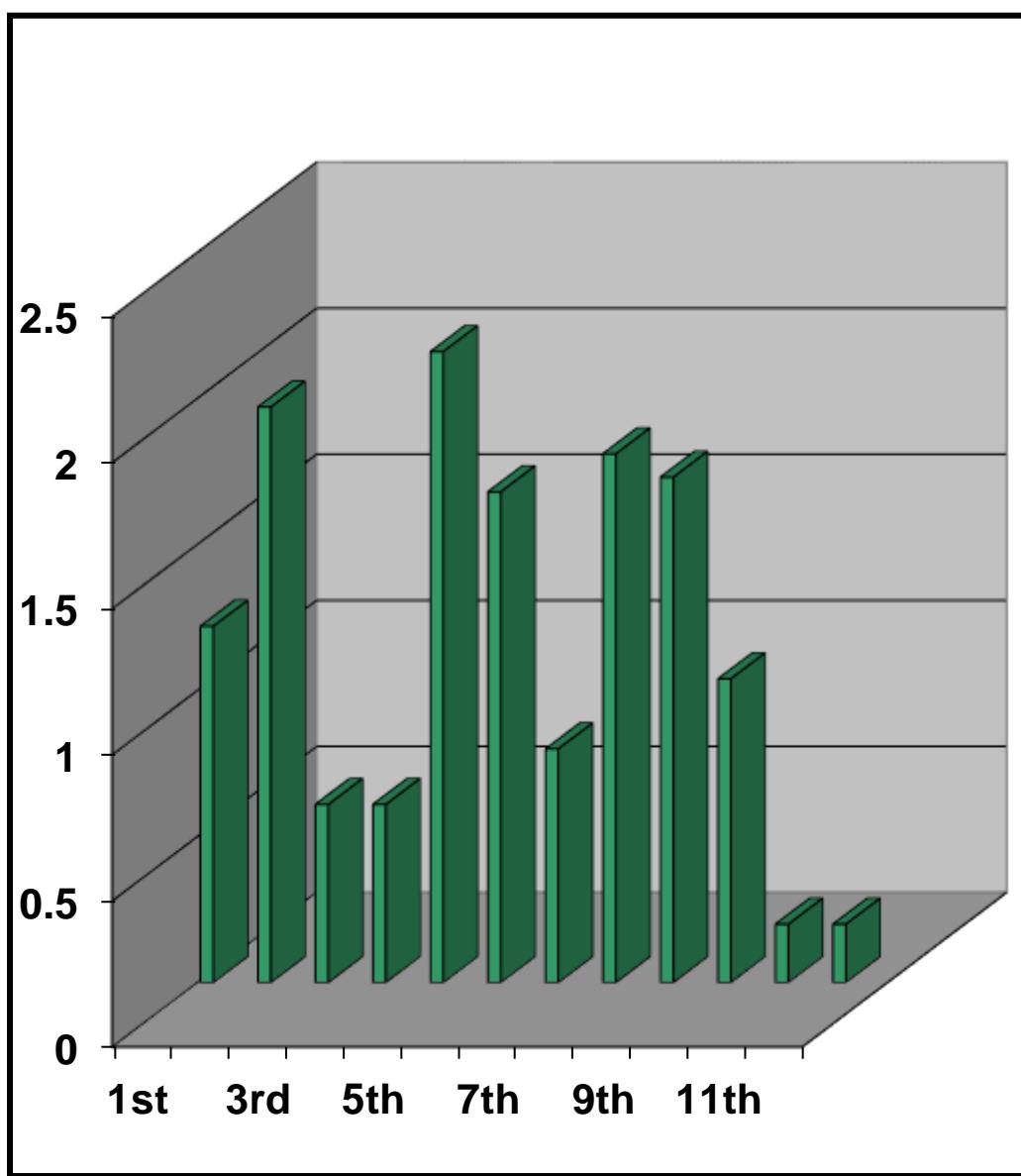


Figure (1) The effect of harvesting date on the percentage of volatile oil production extracted from the *Origanum vulgare L*



Figure (2) the *Origanum vulgare* L



Figure (3) the *Origanum vulgare L* in the flowering stage

Table No. (1) The production rate of the volatile oil of the *Origanum vulgare L* for all months of the year by the hydro-distillation method

Harvesting date	oil yield percentage
15 March / 2004	1.22
15 April / 2004	1.97
15 May / 2004	0.61
15 June / 2004	0.61
15 July / 2004	2.16
15 August / 2004	1.68
15 September / 2004	0.8
15 October / 2004	1.81
15 November / 2004	1.73
15 December / 2004	1.04
15 January / 2004	0.2

15 February / 2004	0.2
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Table No. (2) represents the analysis of variance for the productivity of volatile oil extracted from the *Origanum vulgare L* for all months of the year.

Source of variation	d.f.	ss.	M.s.	F(observed)	F(tabulated) 5% 1%
Treatments	11	12.091	1.099	9.158	2.22 3.9
Error	24	2.899	0.120	9.158	
Total	35	14.990			

3. THE CONCLUSION

The marjoram plant, *O. velgara*, grows to a higher degree in the spring, summer, and fall seasons compared to the winter season. Its growth is determined in winter and resumes its activity in the spring at a high rate, reaching the rate almost in summer. Therefore, it is preferable to harvest the plant three times annually to allow high vegetative growth. The yield is good from the extracted oil, dates 4/15, 15/7, 10/15.

List of abbreviation

The term	abbreviation
<i>Oregano vulgareae</i>	<i>O. vulgareae</i>
Least significant difference	LSD
Complete random design	CRD

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