

Researches on Cultivation of Medicinal and Aromatic Plants in Kayseri

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Received : 04/10/2019

Accepted : 15/12/2019

Abstract

This study comprises the results of demonstrative studies on some medicinal and aromatic plants carried out by Kayseri Directorate of Provincial Agriculture and Forestry under the field conditions in 2015-2017 within the Project of Improving the Medicinal-Aromatic and Dye Plants Cultivations, funded by General Directorate of Plant Production (BÜGEM). In this project, five different plants consisting of lavandin (*Lavandula x intermedia* Emeric ex Loisel), lemon balm (*Melissa officinalis* L.), oregano (*Origanum onites* L.), salep (*Orchis sancta* and *Serapias womeraceae*), and black cumin (*Nigella sativa*) were studied in 11 counties for three years. Desired results were obtained from lavandin, lemon balm, black cumin and oregano plants under the ecological conditions of Kayseri. In terms of cultivation of black cumin, there were not any considerable problems except for weeds affecting sufficient yields. The weed problem was primarily originated by not having herbicides authorized by the Ministry of Agriculture and Forestry. Although application of different planting times and mulching methods in salep plants, desired results couldn't be obtained because of the harsh winter conditions and frost damage.

Key Words: Cultivation, Field Conditions, Medicinal Plants

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1. Introduction

Medicinal and aromatic plants have been used by mankind since ancient times in many fields such as food, medicine, cosmetics, perfumery and spices. Some of these plants are collected from nature and some of them are cultivated. Most of the plants used for therapeutic purposes are still collected from nature (Acibuca and Budak, 2018).

Although more than 40% of the drugs used at the beginning of the 20th century were of plant origin, this rate dropped to less than 5% in the mid-1970s. However, especially after

the 1990s, the discovery of new areas of use of medicinal and aromatic plants and the increasing demand for natural products increase the use volume of these plants with each passing day (Kumar, 2009).

According to World Health Organization (WHO) data, approximately 20,000 plants are used for medical purposes (Baser, 1997). The number of medicinal and aromatic plants cultivated for commercial purposes worldwide is about 900 (Arslan at al., 2015).

Turkey, thanks to its geographic location, climate and plant diversity, agricultural

potential and broad space, is one of the leading countries in the trade of medicinal and aromatic plants. Turkey's importance in this matter stems from the presence of many plants in our country flora which constitute the raw materials to the industry of herbal medicines, drug chemicals, food and additives, cosmetics and the perfumery, in developed countries (Karik et al., 2018).

Therefore, these plants are mostly collected from nature and marketed. In recent years, there has been a significant increase in the use of medicinal and aromatic plants and products derived from them (Gezici, 2018). In order to meet the constantly increasing demand in the coming years, production of medicinal and aromatic plants needs to be increased in order to obtain a better quality standard product. Thus, these plant extracts will increase and the industries that process them will develop (Bayram et al., 2010).

This project has been carried out in the province of Kayseri since 2015 within the scope of the Project of Improving the Medicinal-Aromatic and Dye Plants Cultivations, sustained by General Directorate of Plant Production (BUGEM), carried out on 5 plants (Lavandin, Lemon Balm, Oregano, Salep, and Black Cumin) in 11 counties and furthermore it has been expanding yearly by means of adding new plants. By increasing plant diversity, to determine the alternative crops that can adapt to the ecological conditions of Kayseri and bringing high income from the unit area, to learn the growers the cultivation of these plants and to expand the production of these crops are aimed..

2. Materials and Method

2.1. Materials

The materials used in demonstrations were provided from the Directorate of Aegean Agricultural Research Institution/Menemen-IZMIR, the Directorate of Directorate of Fruit Research Institute/Egirdir-ISPARTA, The

Directorate of Transitional Zone Agricultural Research Institute-ESKISEHIR, and the Directorate of Horticultural Central Research Institute-YALOVA. The species used in the study; *Lavandula x intermedia* Emeric ex Loisel, *Melissa officinalis* L., *Origanum onites* L., *Orchis sancta*, *Serapias vomeraceae*, *Nigella sativa*.

2.2. Methods

Lavandin and lemon balm seedlings were planted in May and oregano seedlings were planted in April. Plant densities were applied as 50x120-150 cm in lavandin, 30x70 cm in lemon balm and 20-30x40-60 cm in oregano plant. Black Cumin seed were sown in April as 15-20 kg ha⁻¹. Fertilizer application In lavandin, lemon balm, oregano and black cumin plants, almost similar to each other pure 4-5 kg / ha nitrogen and phosphorus, in addition, in some locations 1-2 tons / ha in the form of burned animal manure. Salep plants were planted in October in the first year. Salep tubers were planted within a burnt manure-enriched soil bed, 25-30 cm in height and 80-100 cm in width, in 15-15 cm soil depth and 10-20 cm row spacing. Unsuccessful results were obtained in the first year. Therefore, planting time was changed to 3 different planting times as October (a month later than the first planting time), November and December to observe the result of different planting times. Also, different mulching method made of wheat straw and burnt manure, greenhouse and low tunnel methods were tried to see the developments under cover.

3. Results and Discussion

3.1. Lavandin (*Lavandula x intermedia* Emeric ex Loisel)

Lavandin seedlings were obtained in the years of 2015 and 2016. Demonstrative activity researches were carried out at totally 14 locations with a total of 7 locations first year and 7 locations second year. Harvestings were carried out in 2016-2017. Accordingly,

while good results were taken from some locations in all plants, it was not possible to get any results from some of them since just first year or in the other years because of the reasons originated from the growers. In Lavandin, demonstrations were established in 3,35 decares in 7 locations in 6 counties in 2015, in 5,2 decares in 7 locations in 7 counties in 2016, totally in 8,55 decares.

The harvest wasn't made in the first year because of plant growth being slow, however

to enhance the tillering in flowering plants, flowers were dissevered from their stems.

In lavandin demonstrations, constituted in 2015, however even if just a bit desiccations in plants originated from cold weather and frost in some locations in 2015-2016, plants recovered again by tillering with the warming weather in Spring. In three designated locations below, the results of dry flowers yield, essential oil rate and essential oil yield could be obtained.

Table 1. According to the 2. Years (2016) Harvests in Some Locations, Dry Flowers Yields, Essential Oil Rates and Essential Oil Yields

Location Name	Dry Flowers Yield (kg ha ⁻¹)	Essential Oil Rate (%)	Essential Oil Yield (L ha ⁻¹)
Yahyali/Mustafabeyli	1270	6,1	77
Yesilhisar/Merkez	300	5,7	17
Yesilhisar/Kayadibi	680	6,0	48

When examining in Table 1, dry flowers yields, essential oil rates and essential oil yields are seen regarding Lavandin trials results on the grower basis in Mustafabeyli/Yahyali, Yesilhisar and Kayadibi/Yesilhisar. The highest dry flowers yield became in Yahyali, Mustafabeyli Location as 1270 kg ha⁻¹, the lowest dry flowers yield became in Yesilhisar location as 300 kg ha⁻¹. Essential oil rates in dry flower were very close to each other between 5,7-6,1%. While essential oil yields were 77 L ha⁻¹ because of high dry flowers yield in Mustafabeyli/Yahyali location, it was stayed at a lower level of 17 L ha⁻¹ because of low dry flowers yield in Yesilhisar. The reasons why dry flowers rate was so low were those grower retarded the harvest because of his beekeeping and shadows of the trees around flower yields increased more in the following years, but these values could not be measured. As examined in Table 2, the essential oil ratios of the locations in the dry flower ranged between 2,82-9,00%. The highest Felahiye Center is located at the lowest Kocasinan Yazir location. Average essential oil ratio of the locations in dry

flowers was 5,72%. The emergence of a essential oil rate of 9% in the Felahiye Center is an important indicator for this location. The altitude of this location is 1330 m, the south open face, the sun is good and the climatic open days are high. It is a known fact that sunbathing increases the rate of essential oil. In Kocasinan Yazir and Tomarza Isiklar, essential oil ratios were lower than other locations because of the mixing of some lavender flower stalks in dry flower sample and lack of good sample preparation. These essential oil ratios in dry flowers are a good indicator. In the scope of the support given to young farmers in the province, the producers removed the essential oils from the products they obtained in the essential oil distillation system and placed them in small glass bottles and marketed them. Arabaci and Bayram (2005), 1340-4430 kg ha⁻¹, and Arslan et al. (2014) (1620-3410 kg ha⁻¹) reported that low yields of lavender were lower in producers of lavender. the inadequacy, harvest method and the methods of removing the dry flowers from stalks, the lack of sufficient infrastructure in this issue has been due to. Deaf oil yields were also low.

Table 2. The Amount of Essential Oils Obtained in Dry Flower in 2017 Year Harvest in Lavandin Locations (%)

Location Name	Essential Oil Rate (%)	Location Name	Essential Oil Rate (%)
Develi/Sindelhöyük	5,67	Yahyali/Karakoy	6,00
Felahiye/Merkez	9,00	Yahyali/Mustafabeyli	6,80
İncesu/Garipce	5,20	Yesilhisar/Merkez	5,70
Kocasinan/Akcatepe	5,80	Tomarza/Isıklar	4,50
Kocasinan/Yazir	2,82	Average Value	5,72

Otherwise, when we look at the essential oil ratios, we see a rate of 5.7% which is much higher than the values (1.54-2.34%) indicated by Arabaci and Bayram (2005).

3.2. Lemon Balm (*Melissa officinalis L.*)

In 2015, 4 activities were carried out in 0.9 decares area, in 4 locations in 4 counties, in 2016 in 2.05 decares, in 3 locations and in 3 counties. In total, 2,95 decare area demonstrations have been established and followed up.

In the demonstrations established in 2015, a harvest was made in the autumn plants before entering the winter, but there was not much yield. In the winter, although the above-ground parts of the plants completely desiccated in all locations with the arrival of the spring with the new shoots occurred in the plant development was not a problem. Due to winter and cold weather in Kayseri, there was no negative situation. Plant growth and yields were very good after the first year. A harvest in the flowering period in June, and another harvest before the winter in September-October, plants was harvested twice per year. While a high herbage yield was obtained in the first in June, a lower herbage yield was obtained in the second.

In Table 3, while the total dry herbage yield was 5250 kg ha⁻¹, the essential oil rate was 0.08% and the essential oil yield was 4,2 L ha⁻¹ in the Yahyali Mustafabeyli location, these were 6100 kg ha⁻¹, 0.07% and 4,2 L ha⁻¹ in the Kocasinan Yazir location at the 2nd year harvest. The dry and fresh herbage yields for the second year were higher than in the first year, but these data could not be recorded since the yield values could not be weighed. According to this, it can be said that the lemon balm plant is in compliance with the ecological conditions in Kayseri and it has no climatic, disease or harmful problems.

Table 4 shows the rates of essential oil in four locations in the lemon balm plant. According to this, the highest essential oil ratio was found at İncesu Garipce location with the highest rate of 0,24% and the lowest value was found at 0,09% Tomarza Isıklar location. Values are close (0,1-0,35%), to the values reported by Uzun et al. (2014), some higher than the values reported by (Koc, 2002) % 0,01-0,25 and Uyanık and Gurbuz (2014) 0.03-0.08%. According to the results of Abdellatif et al. (2014) 1,54-2,34%, it is slightly lower. Essential oil ratios are close to the findings obtained in our country.

Table 3. Total Dry Herbage, Essential Oil Ratio and Essential Oil Yield Values of Some Locations According to the Harvest Results of the Lemon Balm

Location Name	Dry Herbage Yield (kg ha ⁻¹)	Essential Oil Rate (%)	Essential Oil Yield (L ha ⁻¹)
Yahyali/Mustafabeyli	5250	0,08	4,2
Kocasinan/Yazir	6100	0,07	4,2

3.3. Oregano (*Origanum onites L.*)

Demonstrations in oregano were established in 2016 in 5 locations and 5 counties in a total area of 2.5 decares. Plant growth was very good in locations. A superficial harvest was made before the first year of winter and no significant yield was obtained. In the second

year flowering period, the herbage yields of the plants harvested in June were taken but could not be measured. In some locations 1 and 2 reaps were taken in 2 years, in second reaps in September and October, a very low herbage yield was mentioned. No disease, no harmful organism or no cold and frost damage in winter in the plants was observed.

Table 4. Essential Oil Ratio of Dry Leaf in Lemon Balm According to 2017 Harvest

Location Name	Essential Oil Rate (%)	Location Name	Essential Oil Rate (%)
Yahyali/Mustafabeyli	0,17	İncesu/Garipce	0,24
Tomarza/Isıklar	0,09	Kocasinan/Yazir	0,13

Producers in Yahyali Kopçu and İncesu Garipce locations sold their products in the markets and generated certain amounts of income. In the İncesu Garipce location, the amount of essential oil detected in the 2nd year (2017) *Origanum onites L.* leaves was 4.64%. Since our producer is an organic farming producer, it has been able to pack and sell medicinal and aromatic plants (lavandin, lemon balm, oregano and sage) in the organic market. He is still doing this job.

3.4. Salep (*Orchis sp.*)

Demonstrations in the Salep plant were established in 2015 in 3 counties in 0.9 decares area, in 2016 in 6 locations in 6 counties in 3.2 decares, in a total of 4.1 decares. The first year plantings were made in October. In autumn there was no outflow of tubers. In the spring, there was some output in the Kocasinan location as in March, but they also disappeared with the effect of late frosts in spring. It was planned to investigate different applications such as different planting time, mulching methods and production conditions under cover for 2 years. In order to see the results of different planting time in the 2nd year, 3 different planting time applications were made in a way that the suturing times of the tubers were one month after the first planting time, from September to October-November.

Different mulching methods were tried. To keep the pillows warm, burnt farm manure was laid in straw-straw and some were planted in the greenhouse and some were planted in the form of a low tunnel cover. After planting, demonstrative follow-ups were performed regularly. No improvement was observed in plants in autumn and winter Only in the greenhouse and under the cover planted some output was observed in winter, but in the later stage they disappeared. A few plants were found in the Felahiye location, which overlooks the southern slope of the open area.

It is thought that the winter conditions in Kayseri are hard and long, the damages of late frosts in spring and the salep species used in the spring are unsuccessful due to the cold and frost sensitive species *Orchis sancta* and *Serapias vomeraceae*. Salep plant is a difficult plant culture. (Arabacı et al., 2014), in their study on the Effect of Different Cultural Practices in Salep Orchids, reported that many of the studies conducted for culturing Salep orchids were in vitro studies and that the plants were failing at the stage of adaptation to outdoor conditions. We are of the opinion that in the conditions of Kayseri cultivation of salep plants can be made in other species compatible with the Central Anatolia Region. Tutar et al. (2012) in our opinion in accordance with the salepte each

region of their own species and work with their ecological conditions can be achieved with successful results stated.

3.5. Black Cumin (*Nigella sativa* L.)

The demonstrations in Black Cumin were implemented in 3 locations (13 decares) in 3 counties in 2015, and in 5 locations (14 decares) in 4 counties in 2016, totally in 27 decares. Seed of 15-20 kg per hectare were used for seed decantation in April and sprinkling irrigation was done. Sprouts and exits occurred in locations. However, due to the large number of weed populations, black cumin did not show any improvement. Since the Ministry is not a licensed herbicide and mechanically it is not suitable for anchoring, it is not possible to obtain a product at the level of economic efficiency in black cumin. Because the yield values of the decay remained at very low levels of 100-200 kg ha⁻¹, farmers did not even need to harvest because they could not remove them.

4. Conclusions

The following conclusions can be drawn from these studies conducted in 45.1 decares area in 43 locations in 11 counties in 5 different medicinal and aromatic plant species (Lavandin, Lemon Balm, Oregano, Salep and Black Cumin) for 3 years between 2015-2017.

As the studies were conducted under farmer conditions, the desired results could not be obtained from each demonstration depending on the farmers. In the trials and demonstrations carried out in the farmer's conditions, the choice of the wrong farmers, the lack of equipment and equipment infrastructure at the desired level, the willingness to appear at first, and then the difficulty in raising their work intensity or cultivation in these plants, the lack of interest and the lack of enough results could not be achieved. For these reasons, some demonstrations were disabled at the first stage. However, a certain result has been

reached in the studies. We tried to reduce this risk by establishing the demonstrations at more locations. Under the conditions of Kayseri, these plants can be cultivated economically and they have an idea about their adaptation to Kayseri ecology, their efficiency and quality. These results shed light on local people for those who will work or invest in these plants. As a matter of fact, the Provincial Directorate of Agriculture and Forestry has a lot of people who are interested or not interested in agriculture and want to invest in these matters. These outputs are important in informing and referring them to the right direction.

Under the conditions of farmers, making and conducting these demonstrations cause the producers to recognize and learn these plants, and to recognize, see and be interested in the farmers of the neighboring farmers and other nearby villages. In the next stage, these plants gradually enter the crop rotation in this area and make it become agricultural. There are many examples of this, but this can take many years. Before the start of this project, none of the medicinal and aromatic plants in Kayseri were cultivated and produced. Now some of the producers still continue to grow existing plants, new producers, new plants are added, they are included in municipalities under the leadership of Provincial Directorate of Agriculture and Forestry.

According to this study; In the ecological conditions of Kayseri, positive results were obtained in the cultivation of lavandin, Lemon Balm and oregano plants. Although we do not see a problem in plant growth in the sowing of Black Cumin plants, weed problem has emerged as an important problem. Due to the lack of a medicinal product licensed from the Ministry of Agriculture and Forestry, it was not possible to obtain sufficient yield. In order to be successful in the agriculture of black cumin in Kayseri situations, we think it is necessary to

plant more broadly (40-50 cm) in order to allow the weeding of the weeds mechanically, it would be appropriate to make different sowing times, including autumn, winter and early spring.

Due to the fact that the winter conditions in Kayseri are hard and long, and the species used are not compatible with this region, appropriate results could not be obtained. Salep plant is a plant that is difficult to culture, but we believe that other types of studies compatible with the Central Anatolia region can be done.

Acknowledgements

As the Kayseri Project Team, we would like to thank the Ministry of Agriculture and Forestry, the General Directorate of Plant Production for the Project of Improving the Medicinal-Aromatic and Dye Plants Cultivations.

Conflict of Interest

None

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