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The study of adaptability and results of medicinal plants cultivation in the conditions of Fars province collection

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Abstract

This research was aimed at studying economical and functional considerations, creating live gene bank of medicinal plants (collection) as well as investigation of collective cultivation and breeding of aborigine and exotic species for scientific and investigative considerations to be applied in educational, investigative, and administrative situations. It also was aimed at preventing the genetic extinction of wild medicinal species as well as identifying the nature and resistance of the most important medicinal species which were provided from internal and external resources of the province. Conducting this procedure in the years 2010-2013, 28 species of medicinal plants were cultivated in two medicinal plants collection sites of the province located in the Meymand Research Center of Medicinal Plants and Jihad-E Keshavarzi Center of Kor town (northern Kamfirouz). These species included 20 families and 6 genuses. Seeds, cutting, and seedling of the species were provided from medicinal plants nurseries of Tabiat-E Sarzabz-E Zagros Company. This way, the season of plants cultivation, germination, Stablization, phenology, and resistance to climatic conditions of Meymand in Fars was studied. In addition to understanding of reproduction ways, water requirements, plant Adaptation to dryness, pests, diseases, and wild grass species in the farm were studied as possible. Through this study, among 28 cultivated medicinal plants species 24 species (85.7 percent) completed their phenplogy; 2 species (7.1 percent) remained in vegetative state, 1 species (3.6 percent) went green and, after a while, went dry. 1 species (3.6 percent) didn't go green at all.

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Introduction

The increasing use of medicinal plants as the ingredients of producing herbal medicine without developing appropriate processes of cultivation and accurate planning management would have a disturbing consequence – destruction of nature. Crop production and plant cultivation need to be conducted in agricultural levels, and also their industrial processing should be operated by relevant professionals. Additionally, natural resources should be used as a pattern or model in agriculture and industry for mass production of medicinal materials. In the absence of quality control standards and without following international instructions and legal aspects of medicinal plants business, achieving a profitable market for medicinal plants business seems to be impossible. Therefore producing plants, either raw or processed, with a high level of quality and standards seems to be necessary. In this regard, in the case of medicinal plants, checking farming operations such as cultivation time, reproduction ways, nutrition and its management, harvest time and treatments afterward, has a potential role in production and quality enhancement, so that ignoring each one will cause irreparable damage to medicinal plants and its producers.(Omidbeygi,2010)

Iran with different climatic conditions, having about 8000 plant species and more than 1000 medicinal plants species, is a really suitable place for rare and valuable medicinal species to be obtained. Some of these species can be adjusted and introduced to arable fields. It is also possible to use external improved seeds to be cultivated in fields with climatic conditions suitable for plant's ecological requirements. Since in medicinal plants cultivation obtaining effective material is desired, medicinal plants' farmer should be familiar with all effective factors on growth and qualitative and qualitative functions of his production. Also, he should note that the final performance of medicinal plants cultivation is assessed based on the amount of effective materials per unit area. Therefore, increase in plant's vegetative production per unit area is not the sole assessment criterion. Not knowing the interaction between plants and environmental factors or not paying close attention to the roles of these factors, as well as lack of attention to instruments and accessories required for production cause irreparable lose of time and costs. Because the absence of facilities such as area and appropriate equipments required for drying vegetative of harvested plants or washing the removed roots from soil makes it difficult for farmers to keep the harvested plants for a short period of time, dramatically decreases efficiency, and may lead to complete destruction of production.

Material and methods

This research was conducted in plants garden area of Meymand Research Center of Medicinal Plants (subordinate to Fars University of Medical Sciences) located in Meymand town in Firouz-Abad city, Fars province and Jihad-E Keshavarzi Center of Kor town (northern Kamfirouz). Seeds, sapling, and seedling of the species were provided from medicinal plants nurseries of Tabiat-E Sarzabz-E Zagros Company and were planted indirectly in appropriate seasons. Species which are cultivated by seeds were planted in seriatim, mass planting, and scattering ways in appropriate depths of the main field. After spring planting, irrigation was conducted regularly according to plant's water requirements until crop reaches. During conducting the research design, 28 medicinal plants species including frutescent, aborigine and exotic herbaceous plants were planted in this collection by seeds, cutting, rhizome, and sapling. After plantation, plant's phenology including planting time, germination, blooming time, harvest time was recorded carefully by experts (table 2).

In addition to Plants cultivation and harvesting method operations, the extent to which plants were adaptable to the site's climatic conditions, pests, diseases, and the area's wild grasses was studied as possible. At the same time, the scientific names, Persian names, botanic features, used bodies, ecological requirements, and plants cultivation and harvesting methods were collected separately from

the available scientific sources (Omidbeygi, 2009, 2011, 1993; samsam shariat, 1996; Mozafariyan, 2005; Zargari, 1990-1992).

In order to study the adaptability of the cultivated plants with climatic conditions of the area, plants were divided into three separate categories:

a) Adaptable plants: plants which were fully adaptable to the site's climatic conditions and completed their phonologies. Also, the amount of their production was normal and their cultivation is economical.

b) Relatively adaptable plants: plants which completed their phonologies but the amount of their production were 70-60 percent of the average production.

c) Unadaptable plants: plants which went dry and couldn't complete their phenology during growth because of unadaptability and incompatibility with the area's climatic conditions (Zare Zadeh, 2008).

Climatic status of site 1: the collection of Research Center of Medicinal Plants/ Meymand

Meymand Research Center of Medicinal Plants in located in Fars province, Firouz-Abad city, Meymand town. The average precipitation in the region is 450 mm that more than 85 percent thereof is in winter and spring. The region's average temperature is 28 centigrade. According to Demartin categorization the region is xerothermic climate. This town is situated at the end zones of Zagros Mountains butt. Thus, Meymand has a temarate climate and it is cooler than adjacent areas. Meymand is situated in a plain between two relatively high mounts of Zagros Mountain range, named Sepidar and Padena (Meymand) stretch from northwest to the southeast. Located at the north of Meymand, Sepidar mount is the tail of mount Sabzpooshan in Shiraz and has lots of forests and natural resources. Its summit is 3167 m above sea level. Mount Padena (locally named "Pidno"; it's called "Meymand" in geographical dictionaries, as well) is located in south and southeast of Meymand. There's another low-lying mount called "Gholat" in the west. Parallel to Padena, it is stretched from Sirjan-Khajei to Meymand. It meets Kharman Kooh mount (Kooh Soor) at the east which is seen as a semicircle from Meymand.

Plant cover of mountain forests is mainly mountain pistachio (Pistacia mutica) and peanuts. Meymand has a moderate mountain climate. In the summers it has relatively moderate and dry climate and in the outmen and winter the climate is moderate and humid. The highest temperature occurs in Mordad (August) and the lowest tempreture in Bahman (January). The most amount of seasonal precipitation occurs in Bahman (January) and the average annual precipitation is 450 mm that is snowing in the high areas (Mohamadi *et al.* 2013).

Soil Properties of site 1

Because the plants cultivated in this research prefer medium and light texture, with the help of research center colleagues, a sample of handmade soil provided from certain ratios of sand, grit, and organic materials with 40cm thickness was used in all plots. Results obtained from the soil sample analysis. (Table 1).

Table 1. Results obtained from physical and chemical experiments on sample soil of site 1

No.	Experiment	Amount	Unit
1	EC	2/34	Ds/m
2	gypson	0/02	Meq/100g
3	Organic carbon	0/23	Percentage
4	Total nitrogen	0/06	Percentage
5	Absorbable phosphor	32/1	p.p.m
6	potassium	163/05	p.p.m
7	sand	69/5	Percentage
8	Silt	19/5	Percentage
9	Clay	11	Percentage
10	Texture		-

Climatic status of site 2: Jihad-E Keshavarzi Collection of Kor Town (Northern Kamfirouz)

Having about 83500 hectare area, Kamfirouz region (in Fars province, Marvdasht city) is located in political border lines of two towns –Kor and

Kamfirouz. This region is situated in hillside altitude of 1596 to 3113m above sea level. It has semi-dry and cold climate with extreme temperature fluctuation. The highest precipitation amount, 854.5mm, occurred in (1992) and the lowest amount was 205.5mm in (2006). Towns Kor and Kamfirouz have 18043 hector agricultural and garden lands – 1450 hector gardens and 19593 hectors agricultural lands. Having 83435 hector area, Kamfirouz is geographically located in the distance of 51 grades 58 minutes, 7.8960 seconds, 52 grades, 25 minutes and 32.80 seconds of eastern longitude between 30 grades, 9 minutes,14.2200 seconds and 37 minutes,11.3160 seconds northern latitude (Mohamadi *et al.* 2014).

Soil Properties of site 2

Because the plants cultivated in this research prefer medium and light texture, with the help of research center colleagues, a sample of handmade soil provided from certain ratios of sand, grit, and organic materials with 40cm thickness was used in all plots. Results obtained from the soil sample analysis (Table 2).

Table 2. Results obtained from physical and chemical experiments on sample soil of site 1

No	Experiment	Amount	Unit
1	EC	1/09	Ds/m
2	gypson	1/04	Meq/100g
3	Organic carbon	0/01	Percentage
4	Total nitrogen	0/55	Percentage
5	Absorbable phosphor	36	p.p.m
6	potassium	129/4	p.p.m
7	sand	72	Percentage
8	Silt	13	Percentage
9	Clay	12	Percentage
10	Texture		-

Results

Results of Site 1

According to the results obtained from site 2, among 24 medicinal plant species cultivated in this site, 17 species were adaptable, 4 species were relatively adaptable, and 3 species were inadaptable to its climatic conditions, i.e., 2 species grew and, after a while, went dry and 1 species didn't grow at all.

Identifying wild grasses, this study recognized 18 wild grass species including 7 annual species, 11 perennial species belonged to 4 plant families. Also, 3 pest species and 2 types of medicinal plant diseases were found in the farm.

Those species which didn't grow at all belonged to Non-native species. They didn't grow probably because of some reasons such as lack of seed viability caused by being kept in bad conditions, being retained over time, or especial treatments they need for Germination.

Adaptable species are listed below:

Melissa officinali, *Dracocephalum moldavica, Salvia officinalis, Lippia citriodora, Matricaria chamomilla, Anthemis nobilis L., Tanacetum parthenium, Securigera securidaca, Echinaceae purpurea, Achillea millefolium, Valeriana officinalis, Thymus vulgaris, Mentha piperita, Rosmarinus officinalis, Synarascolymes officinalis, Origanum vulgare*, etc. (Table 3)

Table 3. Phenology and Adaptability of Medicinal Species Cultivated in Fars Province- site 1

No	Scientific name	Reprod-ucible Organ	Cultivation Time	Germination Time	Blooming Time	Removable Organ	Plant's Height in Harvest Time	Harvest Time	Adaptability Status
1	*Lippia citriodora*	Cutting	02/05/2011	10/5/2011	10/08/2011	Leaf	100	30/07/2011	Adaptable
2	*Echinaceae purpurea*	Seedling	02/05/2011	12/05/2011	15/06/2011	Flower, Leaf, Root	75	27/08/2011	Adaptable
3	*Physalis alkekengi*	Seedling	02/05/2011	20/05/2011	10/06/2011	Fruit, Leaf	63	02/10/2011	Adaptable
4	*Mellisa officinalis*	Seedling	02/05/2011	10/05/2011	23/08/2011	Leaf	68	05/08/2011	Adaptable
5	*Dracocephalum moldavica*	Seedling	02/05/2011	08/05/2011	20/06/2011	Leaf	70	03/07/2011	Adaptable
6	*Salvia officinalis*	Seedling	02/05/2011	15/05/2011	20/06/2011	Leaf	56	09/08/2011	Adaptable
7	*Achillea millefolium*	Seedling	02/05/2011	14/05/2011	03/07/2011	Flower	63	13/08/2011	Adaptable
8	*Anthemis nobilis L.*	Seedling	02/05/2011	15/05/2011	29/06/2011	Flower	108	11/08/2011	Adaptable
9	*Oenothera erythrosepala*	Seedling	02/05/2011	12/05/2011	16/08/2011	Seed	175	02/10/2011	Adaptable
10	*Valeriana officinalis*	Seedling	02/05/2011	15/05/2011	20/08/2011	Root	105	07/09/2011	Adaptable
11	*Thymus vulgaris*	Seedling	02/05/2011	10/05/2011	21/07/2011	Leaf and Flowered Twig	45	19/08/2011	Adaptable
12	*Foeniculum vulgare*	Seed	02/05/2011	12/05/2011	31/05/2011	Seed	64	29/09/2011	Relatively Adaptable
13	*Nigella sativa*	Seed	02/05/2011	12/05/2011	-	Seed	65	27/09/2011	Relatively Adaptable
14	*Alyssum homolucarpum*	Seed	02/05/2011	12/05/2011	-	Seed	-	-	Inadaptable
15	*Plantago major*	Seed	02/05/2011	12/05/2011	-	Seed	-	-	Inadaptable
16	*Mentha piperita*	Root Division	02/05/2011	12/05/2011	03/08/2011	Leaf	48	03/07/2011	Adaptable
17	*Hypericum perforatum*	Seedling	02/05/2011	10/05/2011	-	Flower	56	-	Relatively Adaptable
18	*Rosmarinus officinalis*	Cutting	02/05/2011	10/05/2011	16/08/2011	Leaf	59	24/08/2011	Adaptable
19	*Securigera securidaca*	Seed	02/05/2011	12/05/2011	01/07/2011	Seed	56	02/10/2011	Adaptable
20	*Synarascolymes officinalis*	Seed	02/05/2011	15/05/2011	09/09/2011	Fruit	86	31/08/2011	Adaptable
21	*Tanacetum parthenium*	Seedling	02/05/2011	15/05/2011	29/06/2011	Flower	92	11/08/2011	Adaptable
22	*Matricaria chamomilla*	Seedling	02/05/2011	15/05/2011	30/06/2011	Flower	88	19/07/2011	Adaptable
23	*Carum copticum*	Seed	02/05/2011	15/05/2011	16/08/2011	Seed	62	07/10/2011	Relatively Adaptable
24	*Origanum vulgare*	Seedling	02/05/2011	10/05/2011	06/07/2011	Leaf	48	30/07/2011	Adaptable
25	*Pimpinella anisum*	Seed	02/05/2011	12/05/2011	-	Seed	-	-	Inadaptable
26	*Hyssopus officinalis*	Seedling	02/05/2011	15/05/2011	06/07/2011	Flowered Twig	60	-	Adaptable

Results of Site 2

According to the results obtained from site 2, among 14 medicinal plant species cultivated in this site, 12 species were adaptable and 2 species were inadaptable to its climatic conditions.

Identifying wild grasses, this study recognized 11 wild grass species including 7 annual species and 4 perennial species belonged to 5 plant families. Also, 2 pest species and 2 types of medicinal plant diseases were found in the farm.

Inadaptable species included *lippia citriodora* and *salvia officinalis*. *Salvia officinalis* species was mostly stricken by herb dying and died. This problem, however, is removable by disinfecting the seedling and field as well as planting in fields that are away from fungous contamination, especially gardens. *Lippia citriodora* species was hardly settleable because of strong winds in cultivation time, or in the case of being settled, they were destroyed by continuous wind blowing. Region's soil, on the other hand, is mainly composed of clay texture and it's not suitable for cultivating *lippia citriodora*. This problem can be eliminated in two ways: 1) cultivating this species only in fields with medium and light texture having particularly high amounts of organic materials, 2) in the case of cultivation in fields with clay texture, using organic manure, such as compost and peat that repair the soil texture and prevents crustification, before and after cultivation.

Adaptable species were *Mellisa officinalis*, *Physalis alkekengis, Matricaria chamomilla, anthemis nobilis, tanacetum parthenium, echinaceae purpurea, Mentha piperita, Thymus vulgaris, Origanum vulgare*, and etc. Among these, the highest performance belonged to *Mellisa officinalis, Thymus vulgaris, Physalis alkekengis*, and *Echinaceae purpurea*.

Table 4. Phenology and Adaptability of Medicinal Species Cultivated in Fars Province- site 2

No.	Scientific name	Reproducible Organ	Cultivation Time	Germination Time	Blooming Time	Removable Organ	Plant's Height in Harvest Time	Harvest Time	Adaptability Status
1	*Lippia citriodora*	Cutting	06/05/2012	26/05/2012	-	Leaf	-	-	Inadaptable
2	*Echinaceae purpurea*	Seedling	06/05/2012	22/05/2012	24/07/2012	Flower, Leaf, Root	90	06/10/2012	Adaptable
3	*Physalis alkekengi*	Seedling	06/05/2012	19/05/2012	11/07/2012	Fruit, Leaf	63	06/10/2012	Adaptable
4	*Mellisa officinalis*	Seedling	06/05/2012	16/05/2012	04/08/2012	Leaf	68	04/08/2012	Adaptable
5	*Dracocephalum moldavica*	Seedling	06/05/2012	11/05/2012	16/07/2012	Leaf	70	02/08/2012	Adaptable
6	*Salvia officinalis*	Seedling	06/05/2012	14/05/2012	23/07/2012	Leaf	56	08/08/2012	Relatively Adaptable
7	*Anthemis nobilis L.*	Seedling	06/05/2012	13/05/2012	19/08/2012	Flower	108	10/09/2012	Adaptable
8	*Oenothera erythrosepala*	Seedling	06/05/2012	11/05/2012	01/07/2012	Seed	175	01/10/2012	Adaptable
9	*Thymus vulgaris*	Seedling	06/05/2012	16/05/2012	19/07/2012	Leaf and Flowered Twig	45	27/07/2012	Adaptable
10	*Mentha piperita*	Root division	06/05/2012	13/05/2012	24/07/2012	Leaf	48	21/07/2012	Adaptable
11	*Tanacetum parthenium*	Seedling	06/05/2012	14/05/2012	19/08/2012	Flower	92	17/09/2012	Adaptable
12	*Matricaria chamomilla*	Seedling	06/05/2012	14/05/2012	13/07/2012	Flower	88	23/08/2012	Adaptable
13	*Origanum vulgare*	Seedling	06/05/2012	13/05/2012	08/07/2012	Leaf	48	20/07/2012	Adaptable
14	*Hyssopus officinalis*	Seedling	06/05/2012	17/05/2012	04/07/2012	Flowered Twig	60	18/07/2012	Adaptable

Conclusion

This procedure is in progress according to a memorandum of understanding between Tabiat-E Sarsabze Zagros Company and Fars University of Medical Sciences, cooperated by Jihad-E Keshavarzi Organization in Fars province. It is primarily aimed at exploring medicinal plants adaptability with different climatic conditions of Fars province, qualitative and quantitative study of these plants in different regions, suggesting the best species to producers based on quantitative and qualitative aspects in order to increase production and efficiency. The final results of this procedure will be released after the project is finished.

According to the results obtained from this, generally in site 1 research (Meymand Research Center of Medicinal Plants) species with higher adaptability to climatic conditions, stamina and succulence as well as quantitative performance, compared with other species studied in this research, respectively include *Lippia citriodora, Salvia officinalis, Mentha piperita,*

Thymus vulgaris, Synarascolymes officinalis, Rosmarinus officinalis, Dracocephalum moldavica, Mellisa officinalis, Valeriana officinalis, and Achillea millefolium.

In site 2 (Jihad-E Keshavarzi Center of Kor town) species with higher) species with higher adaptability to climatic conditions, stamina and succulence as well as quantitative performance, compared with other species studied in this research, include *Mellisa officinalis, Physalis alkekengi, Echinaceae purpurea, Thymus vulgaris, Matricaria chamomilla*, and *Hyssopus officinalis*.

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