

PLANTATION AGE AS A FACTOR OF CHANGES SOME CHARACTERISTIC OF WILD MARJORAM (*Origanum vulgare* L.)

JEVDJOVIĆ R.¹, FILIPOVIĆ V.², JEVDJOVIĆ JASMINA²

ABSTRACT: In the last few years, demand for wild marjoram is constantly increasing on the medicinal plant's market. The increasing needs cannot be satisfied by natural resources, so cultivation of this plant became necessary. These are results of comparative examination of wild marjoram plantation on different stages of development (one, two or three years old plants). One-year-old plantation had very low yield. Two-year-old plantation had the highest yield, and three-year-old plantation had substantially lower yield of the over-ground biomass. The highest were the plants of two-year-old plantation, and the lowest stem height had the one-year-old plantation. Average, the largest number of secondary sprouts was in the two-year-old plantation, and the lowest number of secondary sprouts was in the one-year-old plantation. The largest content of essential oil was in the two years old plantation and the lowest in the one-year-old plantation.

Key words: wild marjoram, stem height, yield, essential oil.

INTRODUCTION

Wild marjoram (*Origanum vulgare* L.) is an important medicinal, aromatic and seasoning plant. Even Dioscorid and Aristophanes told about it, and Aristotel said that the tortoise that had strangled the snake is that plant trying to save the life (Perrot, 1943/44). Wild marjoram is from family of *Lamiaceae* which consists of about 350 species (Kojić and Pekić Sofija, 1995) divided into many genuses, and there are 28 of them in our flora (Soldatović, 1965). Genus *Origanum* except *Origanum vulgare* L. consists also *Origanum heracleoticum* L., *Origanum majorana* L., *Origanum onites* L., *Origanum creticum* L. and *Origanum dictamnus* L. (Tschirch, 1910).

Considering growing needs for this plant it is more and more grown (Rey, 1997). There are new sorts and hybrids (Tucker and Rollins, 1989), which could give a raw material with higher percentage of thymol, which is about 50 % in essential oil of wild marjoram (Tucakov, 1997). Wild marjoram is also used as seasoning (Duke, 1985). Nevertheless, it's the most important use is as raw material for essential oil (0,15 – 1 %), (Stepanović, 1998). The essential oil has widespread use, in medicine and pharmaceuticals, but also in cosmetics, cooking and plant protection (Guenther, 1949; Stella Kokkini, 1997;

¹ Institute for Medicinal Plants Research "dr Josif Pančić", T. Košćuška 1 11000 Belgrade

² Faculty of Agriculture, Nemanjina 6, 11081 Belgrade-Zemun

Marković and Kostić, 1997; Marković, 1997). In the Far East it is used as decorative plant because of its flowers, and as parasicide.

This herb is much respected among people. It is used as stomachic; it could intensify gland secretion of digestion organs and intestines peristaltic. It is also used as tea against cold and bronchitis (Turova, 1974; Zalecki, 1985). This plant has very strong spasmolytic and antibacterial effects (Bezanger – Bealiquesne et al., 1975).

Wild marjoram is reproduced by seedlings, but if we want to intensify the process we use sowing by cluster dividing and recent time, it is grown using culture meristem tissue (Svoboda et al., 1995; Erzen-Vodenik and Baricevic, 1996). Like almost all plants from family of *Lamiaceae* wild marjoram is false dried on temperature of 28 – 32 °C. It is packed in carton and it is left in dry and draughty place (Paakkonen et al., 1990).

The scientists from South Italy and Greece achieved in their researches the highest percentage of carvacrol and thymol in essential oil and considerable greater yield of cultivated wild marjoram comparing the one growing wild (De Mastro et al., 2004; Panetos et al., 1993; Economakis and Fournaraki, 1993). In late seventies and at the beginning of eighties of the last century in Israel at introduction, selection and commerciality of cultivation a high yield and good quality types of wild marjoram had been created (Putievsky and Basker, 1977; Putievsky and Ravid, 1982; Putievsky and Ravid, 1984). In studies of scientists from Argentine, some of the parameters, researched in this particular study, had been analyzed: the yield of fresh and dry over ground mass, the stem height and the contents of essential oil (Rossi et al., 1999; Curioni et al., 2002).

The aim of research was to study and show which year of treatment wild marjoram has the highest yield of over ground mass and when the quality of raw material is the best.

MATERIAL AND METHODS

In this research, wild marjoram (*Origanum vulgare* L.) sort was tested. It is cultivated and reproduced at the Institute for Research medicinal plants "dr Josif Pančić" from Belgrade.

Seedlings were produced from seed which was 98 % cleanliness and 96 % of germination, in protected place (greenhouse). After planting, the distance between rows was 70 cm and between plants in row it was 30 cm. Planting was done in four repetitions in the third decade of April (2000, 2001 and 2002). The experimental parcels were 20 m². During the period of vegetation, certain measures of care had been done. The secondary stems of all planting and repetitions were counted before harvest. The stem height was measured, too.

Harvest was very important in this research. It was done in the third decade of July 2002, in period of full bloom, on all parcels. The yield of fresh over ground mass of three years, two years and one year tasting plants was measured. After that, the over ground mass was dried on natural way (in thin layer on draughty place) in a shade. The drying was finished when humidity was 10 %. After drying, the yield was measured again. After all, the patterns of dry, plants from all repetitions were taken, so it could be possible to find out the contents of essential oil. Distillation was done with device Clevenger.

RESULTS AND DISCUSSION

Average values of parameters we came by in the region of Panchevo were correspondent with values received from different climate conditions studies in Europe, Near East and South America (table 1).

Table 1 Yield and plantation quality parameters of wild marjoram

Plantation	Height of secondary stems, cm	Number of secondary stems	Yield of fresh over ground mass, kg/ha	Yield of dry over ground mass, kg/ha	Content of essential oil, %
One-year-old	26,9	4,5	279,8	146,8	0,105
Two-year-old	47,0	53,8	15.172,5	7.854,0	0,228
Three-year-old	32,8	50,5	7.080,5	3.213,0	0,138

LSD	Significant level	Height of secondary stems, cm	Number of secondary stems	Yield of fresh over ground mass, kg/ha	Yield of dry over ground mass, kg/ha	Content of essential oil, %
	0,05	8,763	48,982	4.853,047	2.485,183	0,104
	0,01	13,277	74,214	7.353,074	3.765,414	0,158

Statistically the great difference in the height of secondary stems in the field of wild marjoram was between values of two year treatment and other two. Two-year-old plantation had the greatest secondary stems, which approximately were 14,2 cm higher than three-year-old plantation and 20,1 cm, comparing one-year-old plantation.

The results of secondary stems number show the statistically in one-year-old plantation and its values were eleven times lower comparing the older treatments. There were no important variations considering the relation between number of secondary branches in two- and three-year-old plantation, and it didn't results the statistically importance.

Higher yield of fresh over ground biomass was in two-year-old plantation comparing to one-year-old plantation, and it was the result of an intensive growth and development in period from the first to the second year of cultivation. After that, in the third year, the yield of fresh mass was "halved" from 15.172,5 kg/ha to 7.080,5 kg/ha.

Dried over ground mass had the statistically very important variation in two-year-old plantation and it had approximately the highest values of that reference. Dry over ground mass yield in two-year-old plantation was about 2,5 times higher than the yield in three-year-old plantation and 53 times than the yield in three-year-old plantation. This high difference influenced on yield creating statistical importance of dry mass between three-year-old plantation and one-year-old plantation.

All treatments had the values on, "the edge" that given for quality evaluation of *Origani herba* drug considering the contents of essential oil, but, otherwise, the dry over ground mass yield was higher than usual. Two-year-old plantation had approximately the highest values (0,228 %) and that was statistically very important comparing to one-

year-old plantation. In two-year-old plantation, in one of repetition it was noticed an important variation, and that variation influenced on contents of essential oil of this treatment which was the best, considering all parameters.

CONCLUSION

After the research and analyzing the results we could conclude:

- The highest over ground mass yield and higher percentage of essential oil were in two-year-old plantation.
- The number of secondary stems is in direct correlation with yield - quantity.
- It should continue sowing in autumn, because one-year-old plantation sown in spring had very low yield.

REFERENCES CITED

- Bezanger – Bealiquesne L., Pinkas M., Torek M. (1975): Les plantes dans la therapeutique moderne. Maloine S.A. éditeur. Paris. 375.
- Curioni A., Carcia M., Rolando A., Alfonso W., Arizio O. (2002): Produccion de oregano (*Origanum vulgare* L.) y tomillo (*Thymus vulgaris* L.) en el centro – oeste Bonaerense. I Latin-American Symposium on the Production of Medicinal, Aromatic and Condiments Plants. February 2002. Sao Pedro, Sao Paulo, Brazil. Acta Horticulturae. No. (569/46)
- De Mastro G., Ruta G., Marzi V. (2004): XXVI International Horticultural Congress: The Future for Medicinal and Aromatic Plants. January 2004. Toronto, Canada. Acta Horticulturae. No. (629/46)
- Duke J.A. (1985): Culinary herbs a potpurri. Trado – Medic Books, Conch magazine Ltd. New York. USA.
- Economakis C.D., Fournaraki C.E. (1993): Growth and nutrient uptake of *Origanum vulgare* ssp. *hirtum* in solution culture. First World Congress on "Medicinal and Aromatic Plants for Human Welfare, WOCMAP: Raw material production, product introduction," July 19-25, 1992, Maastricht, Netherlands. Acta horticulturae. Sept 1993. no. (331) p. 345-350.
- Erzen-Vodenik M., Baricevic D. (1996): Tissue propagation by medicinal and aromatic plants. Proceedings of the Symposium on New Challenges in Field Crop Production. University of Ljubljana, Biotechnical Faculty, Ljubljana (Slovenia). Agronomy Dept. Ljubljana (Slovenia). Dec 1996. p. 201-206.
- Guenther E. (1949): Oil of origanum. In: The essential oils, Vol. 3 Individual essential oils of the plant families *Rutaceae* and *Labiatae*. Kreig. Florida. USA. pp. 535 – 545.
- Kojić M. i Pekić Sofija (1995): Botanika, Nauka, Beograd.
- Marković T. (1997): Mogućnost primene etarskog ulja *Origanum vulgare* ssp. *Hirtum* u kontroli Botrytis cinerea Pers. na paradajzu. Lekovite sirovine, god. XVI. broj 16, str. 53 – 57.
- Marković T. i Kostić M. (1997): In vitro ocena fungitoksičnosti etarskog ulja *Origanum vulgare* ssp. *hirtum* L. Arhiv za farmaciju. Beograd. god 47. br. 5, str. 632 – 633.
- Paakkonen K., Malmsten T., Hyvonen L. (1990): Drying, packaging, and storage effects on quality of basil, marjoram and wild marjoram. Journal of food science: an official publication of the Institute of Food Technologists (USA). (Sep-Oct 1990). v. 55(5) p. 1373-1377, 1382.

- Panetos K., Nikolaidis A., Lyrantzis G., Kargiolaki G., Fournaraki C., Lymberakis P., Skuola M. (1993): Identification, preservation, adaptation and cultivation of selected aromatic and medicinal plants suitable for marginal lands of the Mediterranean region. First World Congress on "Medicinal and Aromatic Plants for Human Welfare, WOCMAP: Raw material production, product introduction," July 19-25, 1992, Maastricht, Netherlands. Acta horticulturae. Sept 1993. no. (331) p. 191-197.
- Perrot E.: Matières premières du regne végétale, Paris 1943 – 44, Tome II, 2013 – 2014.
- Putievsky E. and Basker D. (1977): Experimental cultivation of marjoram, oregano and basil. Journal of horticultural science. J Hort Sci Apr 1977, 52 (2) p. 181-188.
- Putievsky E. and Ravid U. (1982): Variations in yield parameters in a wild population of *Origanum vulgare* L. "in Israel". World crops: production, utilization, description. World Crops Prod Util Descr 1982. v. 7. p. 237-248.
- Putievsky E. and Ravid U. (1984): Differences in yield and essential oils of various types of *Origanum vulgare* L. grown under intensive cultivation conditions. IV International Symposium on Spice and Medicinal Plants. June 1984. Angers, France. Acta Horticulturae. No. (144/9)
- Rey Ch. (1997): Oregano in Switzerland: Market, production and research. Proceedings of the IPGRI International Workshop on Oregano, 8 – 12 may 1996, CINEAM, Valenzano (Bari), Italy, ed. S.Paludosi IPGRI, Roma 140.
- Rossi E.R., Solbes D., Boldrini C., de Olsen A. (1999): Behaviour of marjoram (*Origanum vulgare* L.) clones in relation to climatic variables II WOCMAP Congress Medicinal and Aromatic Plants, Part 3: Agricultural Production, Post Harvest Techniques, Biotechnology December 1999 Mendoza, Argentina . Acta Horticulturae. No. (502/9)
- Soldatović M. (1965): Farmakognoksijska studija *Origanum heracleoticum* L. – doktorska disertacija.
- Stella Kokkini (1997): Variation of essential oils along the climatic – geographic gradient of Greece: the case of *Mentha pulegium* and *Origanum vulgare*. Arhiv za farmaciju. Beograd. god 47. br. 5, str. 405.
- Stepanović B. (1998): Proizvodnja lekovitog i aromatičnog bilja, Institut za proučavanje lekovitog bilja "Dr. Josif Pančić", Beograd.
- Svoboda K.P., Finch R.P., Cariou E., Deans S.G. (1995): Production of volatile oils in tissue culture of *Origanum vulgare* and *Tanacetum vulgare*. International Symposium on Medicinal and Aromatic Plants, August 21-27, 1994, Kyoto, Japan. Acta horticulturae. Nov 1995. (390). p. 147-152.
- Tschirch A. (1910): Handbuch der Pharmakognosie, Leipzig.
- Tucakov J. (1997): Lečenje biljem, Rad, sedmo izdanje, Beograd.
- Tucker A.O., Rollins E.D. (1989): The species, hybrids and cultivars of *Origanum (Lamiaceae)* cultivated in the United States. Baileya 23 (1): 14 – 29.
- Turova A.D. (1974): Lekarstvenie rastenij SSSR i primenenie. Medicina. Moskva. 63.
- Zalecki R. (1985): Uprawa lebiodki pospolitej. Wiadomosci Zielarskie (Poland). v. 27 (5-6) p. 2-4.