ESTABLISHMENT MODE AND TIME OF CUTTING OF LAVENDER PLANTS FOR REGENERATION TO OBTAIN THE BEST FEATURES OF DECORATIVE AND VOLATILE OIL PRODUCTION

STABILIREA MODULUI ŞI A EPOCII DE TĂIERE PENTRU REGENERAREA PLANTELOR DE LAVANDĂ ÎN VEDEREA ÎMBUNĂTĂŢIRII CARACTERISTICILOR DECORATIVE ŞI PRODUCŢIEI DE ULEI VOLATIL

POP M. R.[1], SAND Camelia[1], BOBIŢ Dana[2], ANTOFIE Mihaela[1], BARBU H.[1], PĂŞCANUŢ I.[1], CIORTEA G.[1], BLAJ R.[1], MUNTEAN L.[3], SAVATTI M.[3]

e-mail: mihaipop76@yahoo.com

Abstract. *In the technology of growing lavender, cutting shrubs to regenerate plants can influence inflorescence height, decorative capacity and production of oil. For this reason, the experimental versions exposed for this research study, present researches undertaken in order to determine the optimal timing for such operations and the height used for reaching efficiency both for those who want to use this species for ornamental purposes and for those who seeks a high production of oil. In this respect, observations and measurements were made in the inflorescence and the amount of volatile oil dosages. Statistical interpretation of data obtained show the superiority of regeneration cuts made in November or March, compared with those in July.*

Key words: *Lavandula angustifolia*, inflorescence, length, mass, vertical, volatile oil

Rezumat. *În tehnologia de cultivare a lavandei, tăierea tufelor pentru regenerarea plantelor poate influenţa major înălţimea inflorescenţelor, capacitatea decorativă şi producţia de ulei volatil. Din acest motiv, variantele experimentale ale studiului de faţă expun cercetări cu privire la stabilirea momentului optim de efectuare a acestei operaţii precum şi înălţimea la care se efectuează pentru a obţine eficienţa atât pentru cei ce doresc folosirea acestei specii în scop ornamental cât şi pentru cei ce urmăresc obţinerea unei producţii ridicate de ulei volatil. În acest sens, s-au efectuat observaţii şi măsurători la nivelul inflorescenţelor şi dozaje a cantităţii de uleiul volatil. Interpretarea statistică a datelor obţinute demonstrează superioritatea tăierilor de regenerare efectuate în lunile noiembrie sau martie, comparativ cu cele efectuate în iulie.*

Cuvinte cheie: *Lavandula angustifolia*, inflorescenţă, lungime, masă, verticile, ulei volatil

[1] "Lucian Blaga" University of Sibiu, Romania

[2] National Institute of Research and Development for Potato and Sugar Beet Brasov, Braşov, Romania

[3] University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania

INTRODUCTION

Lavandula angustifolia Mill. has as primary usage in ancient times, due to scent baths pleasant flavor that gives to the water, and its soothing, antiseptic and healing of wounds action (Pârvu, 2004).

Subsequent writings show that the species can be considered one of the best tonic herbs for the nervous system, the infusion of flowers can even combat depression and melancholia. Flowers chase moth, having a repellent effect and being a good perfume for the clothes as well. For medicinal purposes are exploited the soothing, carminative, analgesic, antiseptic, diuretic properties etc. (Munteanu, 2007). The efficiency of oil production in recent years has increased from 2.3 to 2.6% (Hassiotis et al., 2010). Spectrum of uses of the species does not stop here, the flower being a valued ornamental and honey plant. In green spaces, *Lavandula angustifolia* Mill. can be planted either alone or in groups, in combination with other medium-sized perennial flower species, in rounds rebate, on lawns or even in street ware.

Technology introduction and definition of culture have been made in our country since 1950 near Brasov (Evdochia Coiciu, 1962) and in 1955, Traian Savulescu has made the first works to study the variability (Pârvu, 2004). The species is perennial and can stay in the same place more than 20 years if plants are properly maintained. Otherwise, the plantations can be damaged easily because of irrational exploitation. This study was done in order to highlight the extent to which the applied cut at *Lavandula angustifolia,* in certain times and at different heights, affect the ornamental value and quantity of essential oil gained.

MATERIAL AND METHOD

Biological material with whom have been created the experimental versions belongs to Codreanca variety. The seeds were provided by the National Institute of Research and Development for Potato and Sugar Beet - Laboratory of Medicinal Plants, Brasov. From the seeds, was produced in 2005 seedlings that was used to establish experimental plots. The experiment was polifactorial and was organized by randomized block method (Ardeleanu, 2006). The two variables used in the experiment were the moment when were done the cuts of regeneration and the height at which they were made.

Planting scheme had distances of 100 cm between rows and 50 cm on the rows, resulting in a density of 20,000 plants / ha (Piroşca, 2000). The flowers collection began in the second year of culture, as stated by Păun (1995). After the fourth harvest, in 2009 cuts were applied to bush regeneration in several ways, depending on how the experimental field was organized. In the first experimental variant the regeneration cuts were made in July, immediately after harvest. The next experimental version the cuts have been applied in autumn, in November. In the third variant, cuts were applied in March the next year. In the fourth variant there were no regeneration cuttings. During the growing season that followed, there have been made observations and measurements of vertical inflorescence number, inflorescence length.

At collection moment, there has been weighed, separately on variants, the inflorescence mass harvested and then passed to the determination of volatile oil.

The first three experimental variants was introduced the second variable, cutting height from the ground. This was done at heights of 3 cm and 10 cm respectively.

For extraction of volatile oil were used fresh blossoms. The technique used was the steam being caught using a laboratory-type facilities Neo - Clevenger (Jitianu and Georgescu, 1999).

The data were recorded in a table and were subject to interpretation by statistical analysis of variance in the number of vertical inflorescence, inflorescence length, inflorescence mass harvested and the amount of volatile oil obtained (Ardeleanu and Sestraş, 1996).

RESULTS AND DISCUSSIONS

The values of experimental measurements mentioned above can be discussed based on the use of plants of *Lavandula angustifolia* Mill. If the aim of regeneration after the cutting is an aesthetic one**,** then of course we would be interested in the performances in terms of number of flower blossom or its length. At these plants, the flowers are grouped in vertical inflorescence (Pârvu, 2004), which is directly proportional, from a numerical point of view, with the inflorescence length. As such table 1, which shows the performance achieved by our experimental variations in the number of vertical, shows the version where the number of vertical of the inflorescence was the highest, respectively 8, was the one where the regeneration of the cut was made at 3 cm, in November. The following, is one made in March, with a value of 6 vertical inflorescence.

Table 1

Influence of cutting height and time for regeneration of plants of *Lavandula angustifolia* Mill. on the number of vertical blossom

No	Cutting height	Age (months)	Number of vertical / Flowering			
			Pcs.	%	Difference	Significance
1	Cut at 3 cm	July	3	100	0	-
		November	8	266,67	5	***
		March	6	200	3	*
2	Cut at 10 cm	July	3	100	0	-
		November	4	133,33	1	-
		March	4	133,33	1	-
3	Uncut (Mt)	-	3	100		-
4	DL 5%				2,44	
	DL 1%				3,39	
	DL 0,1%				4,91	

The lowest values were recorded in cases where the regeneration cuts were made at a height of 10 cm or were made immediately after harvest in July or were not made at all. Among these cases the differences were small, the values ranging between 3 and 4 vertical inflorescence.

Inflorescence length is another factor through which the aesthetic value of plants of *Lavandula angustifolia* Mill. can be put into relief. Performances were

recorded in all the variants where regeneration cutting was performed at 3 cm, in November (table 2).

Table 2

Influence of cutting height and time for regeneration of plants of *Lavandula angustifolia* Mill. on the length of inflorescence

No	Cutting height	Age (months)	Inflorescence length (cm)			
			Length	%	Difference	Significance
1	Cut at 3 cm	July	3,1	110,71	0,3	-
		November	7,2	257,14	4,4	***
		March	5,7	203,57	2,9	*
2	Cut at 10 cm	July	2,5	89,29	-0,3	-
		November	4,2	150	1,4	-
		March	4,5	160,71	1,7	-
3	Uncut (Mt)	-	2,8	100		
4	DL 5% DL 1% DL 0,1%				2,31 3,21 4,66	

As in the case of analyzing the number of vertical blossom, the next version, in descending order of values, is the one where the cut was short and was made in March. It is highlighted positive influence of the number of vertical on the length of inflorescence, with clear implications for decorative effects in plants.

In tables 3 and 4 there are the results of parameters related to the productive capacity of the plant at all experimental variants. The flowers harvested in July**,** were weighed immediately.

Table 3

Influence of cutting height and time for regeneration of plants of *Lavandula angustifolia* Mill. on the mass of inflorescences

No	Cutting height	Age (months)	Inflorescence mass (t / ha)			
			Production	%	Difference	Significance
1	Cut at 3 cm	July	0,95	141,79	0,28	-
		November	3,83	571,64	3,16	***
		March	3,21	479,10	2,54	**
2	Cut at 10 cm	July	0,45	67,16	-0,22	-
		November	1,36	202,99	0,69	-
		March	1,65	246,27	0,98	-
3	Uncut (Mt)	-	0,67	100		
4	DL 5% DL 1% DL 0,1%				1,62 2,26 3,27	

The largest amount of flowers were collected from variants where the regenerating cuttings were short, to 3 cm and done in the months of rest, in November and March. Through apical dominance**,** the most vigorous shoots are formed from the terminal and closest shoots. The cuts made have eliminated this phenomenon**,** prompting the vegetation of basal shoots. From the data obtained,

abundant growth is highlighted, and the emergence of more flowers for short cuts. Thus**,** at the version cut to 10 cm and the witness, were obtained the lowest values for all parameters. This indicates that the shoots placed in terminal and superior position shoots generate lower growth than the other variants.

Table 4

Influence of cutting height and time for regeneration of plants of *Lavandula angustifolia* Mill. on the quantity of volatile oil

No	Cutting height	Age (months)	Oil quantity (l / ha)			
			Production	%	Difference	Significance
1	Cut at 3 cm	July	7,1	151,07	2,4	-
		November	33,72	717,45	29,02	***
		March	29,66	631,06	24,96	**
2	Cut at 10 cm	July	3,36	71,489	-1,34	-
		November	11,96	254,47	7,26	-
		March	12,99	276,38	8,29	-
3	Uncut (Mt)	-	4,7	100		
4	DL 5% DL 1% DL 0,1%				12,84 17,85 25,85	

The amount of oil is directly proportional to the mass of fresh flowers harvested.

An interesting aspect is the influence and timing of making cuts, the regeneration cuts described in the experiment conducted in November and March had the best results. Perhaps this is because in winter the concentration of cellular juice is higher**,** leading to a slight wound healing, loss through drying is less. This can be confirmed that the variant in which the cuts were made at 3 cm, but in July, results were lower in all parameters studied. They are smaller than the values obtained for variants in which cuts were made at 10 cm, but in the cold season, or were not executed.

CONCLUSIONS

1. Version witness, which had no cutting, recorded the worst results in terms of vertical inflorescence number, inflorescence length, inflorescence mass and the quantity of oil.

2. Regeneration cuttings carried out immediately after harvest have negative effects, the results are very close to the witness version.

3. The variant which consistently showed significant differences, compared with positive control, was the version where the cuts were made at 3 cm in November.

4. The experiment demonstrates that regeneration cuts occur in physiological balance, positively affecting both vegetative growth and floral induction.

5. Regeneration cuttings may have a role in regulating metabolic processes which have biochemical implications in plastic and circulation of the hormone and thus influenced the quantity of oil accumulated in the flowers.

6. Both for decorative purposes and for collection of flowers, it is recommended that the regeneration cutting process is made at 3 cm, in November.

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REFERENCES

1. Ardelean M., 2006 - *Principii ale metodologiei cercetării agronomice şi medical veterinare*. Academic Pres, Cluj-Napoca;

2. Ardelean M., Sestraş R., 1996 - *Ameliorarea plantelor şi tehnică experimentală, partea a II-a, Tehnică experimentală, îndrumător de lucrări practice*. Tipo Agronomia, Cluj-Napoca;

3. Coiciu Evdochia, Racz G., 1962 - *Plante medicinale şi aromatice*. Editura Academiei RPR, Bucureşti.

4. Hassiotis C.N., P.A. Tarantilis, D. Daferera, M.G. Polissiou, 2010 - *Etherio, a new variety of Lavandula angustifolia with improved essential oil production and composition from natural selected genotypes growing in Greece*. Industrial Crops and Products, http://www.elsevier.com/locate/indcrop

5. Jitianu Corina, Cecilia Georgescu, 1999 - *Chimie organică. Tehnici experimentale. Partea I*, Editura Universităţii „Lucian Blaga", Sibiu.

6. Muntean L.S., Tamas M., Muntean S., Muntean L., Marcel D., Varban D., Florian S., 2007 - *Tratat de plante medicinale cultivate si spontane*. Risoprint Press, Cluj-Napoca;

7. Pârvu C., 2004 - *Enciclopedia plantelor*. Tehnica Press, Bucureşti;

8. Păun E., 1995 – *Sănătatea Carpaţilor*. Editura F&D Still Commerce, Bucureşti;

9. Piroşca L., 2000 - *Tehnologii de cultură la plantele medicinale şi aromatice*. Editura Orizonturi, Bucureşti;

10. Vârban D.I., Rodica Vârban, A. Imre, 2005 – *Plante medicinale şi aromatice cultivate şi din flora spontană*. Risoprint Press, Cluj-Napoca;