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Effects of some products for foliar application on the productivity and essential oil content in lavender (*Lavandula angustifolia* Mill.)

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Abstract

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The experiment was conducted in the period 2018-2020 in the region of Razgrad, the land of Osenets village, North-eastern Bulgaria on soil type Chernozem and an experimental area of 500 m^2 in four replications with lavender variety Sevtopolis.

The following foliar fertilizers and biostimulators were included in the study at the respective rates: Variant 1 – Fertigrain foliar – 1.5 l/ha, Variant 2 – Amalgerol – 3.5 l/ha, Variant 3 – Fertileader vital – 3 l/ha, Variant 4 – Siapton – 3 l/ha. They were applied at the end of buttoning and the beginning of flowering stage. In order to follow out the effect of those products on the elements of productivity, essential oil content, inflorescences and essential oil yield, the variants were compared to an untreated control (Variant 5). The experiment was carried out following the adopted cultivation technology. The following characteristics were reported: number of tuft inflorescences, length of flowering stem, number of flower nodes, weight of tuff inflorescences, yield of fresh inflorescences – kg/ha, essential oil content – % and yield of essential oil – kg/ha.

Data obtained for the values of the structural elements, the yield and the essential oil content were statistically processed by the method of dispersion and correlation analyses.

The results showed: the structural elements of the yield – number of tuft inflorescences, length of flowering stem, number of flower nodes and weight of tuff inflorescences in the treated variants exceed the untreated control up to 8.9%, 11.3%, 19.34% and 13.6% respectively.

The increase in flower yield in the products used for foliar application was in the range from 69 to 580 kg/ha compared to the control variant. The highest yield was reported in the variant treated with the preparation Siapton 3 l/ha – 6280 kg/ha. Compared to the untreated control in foliar fertilization with the tested products was reported an increase in the content of essential oil, and the highest values were when used the product Fertilider vital 3 l/ha – 1.69% to 1.51% for the control variant. The yield of essential oil was with the highest values when used the products Fertileader vital 3 l/ha and Siapton 3 l/ha and exceed the control variant by 18.2%.

Keywords: biostimulants; essential oil %; essential oil yield; foliar fertilizer; inflorescences yield; lavander

Introduction

Lavender is one of the most common essential oils in the world. The world market of this culture is developing dynamically due to its diverse use and interests in products of natural origin (Stanev & Dzhurmanski, 2011). With the ongoing climate change and especially with the emerging warming, lavender is becoming increasingly popular culture, especially from an economic point of view (Yanchev, 2017). In order to increase the lavender inflorescences yield and the content of essential oil, as well as the possibility for the culture to predetermine some abiotic stress factors, it is crucial to include more agrotechnical and agrochemical measures, which include the use of plant growth control stimulants (Rafiee et al., 2016). These products show an effect by enhancing metabolism, activating the absorption of nutrients and helping to pre-determine them in the organism (Giannoulis et al., 2020). They stimulate or suppress the physiological processes that determine the growth of the plants. Unlike other nutrients, they do not serve as food, but affect the course of life processes, the rate of the growth, coordinate the activity of its individual organs (Nickell, 1982). A number of studies have found that the application of foliar fertilizers and growth regulators in lavender is an appropriate method to stimulate the biological potential of the plants. As a result were obtained higher values of the elements of productivity, inflorescence yield and essential oil content compared to the control variant (Camen et al., 2016; Chrysargyris et al., 2017; Jelačici et al., 2008; Silva et al., 2017; Yasemin et al., 2017; Minev, 2020; Mirrabi et al., 2014; Skipor et al., 2018). The results of these studies show that lavender responds positively to the growth regulators, biostimulators and foliar fertilizers used, which allows continuing the research with this crop.

The aim of the study was to investigate the effect of some foliar fertilizers and biostimulants on the elements of productivity, essential oil content, inflorescence yield and essential oil in lavender variety Sevtopolis.

Materials and Methods

The experiment was conducted in the period 2018-2020 in the region of Razgrad, the land of Osenets village, Northeastern Bulgaria on soil type Chernozem and an experimental area of 500 m^2 in four replications with lavender variety Sevtopolis.

The following foliar fertilizers and biostimulators were included in the study at the respective rates: Variant 1 – Fertigrain foliar (biostimulator with content – organic matter – 40%; Amino acids – 10%; Total nitrogen – 5%; Zn; Mn; B; Fe; Cu; Mo; Co) – 1.5 l/ha, Variant 2 – Amalgerol (organic biofertilizer with the content of algae extract, distilled paraffin oil, herbal extracts from the Alps, mineral oils, plant extracts and essential oils) – 3.5 l/ha, Variant 3 – Fertileader vital (biostimulator with content – 9% N; 5% P_2O_5 : 4% K_2O; B, Cu, Fe, Mg, Mn, Zn) – 3 l/ha, Variant 4 – Siapton (organic fertilizer and biostimulator with content – total nitrogen 9.1%; organic nitrogen 8.7%; Ammonium nitrogen 0.4%; Organic carbon 25%; Total amino acids 54.4%; Free amino acids 10.0%; Dry matter 63%) – 3 l/ha. They were applied at the end of buttoning and the beginning of flowering stage. In order to follow out the effect of those products on the elements of productivity, essential oil content, inflorescences and essential oil yield, the variants were compared to an untreated control (Variant 5). The experiment was carried out following the adopted cultivation technology.

Annually were performed 4 – 5 mechanized tillages between rows and 2 – 3 in-rows, manual, weed control and soil loosening. In spring, before the first tillages between rows, 10-12 kg/da N were applied, and in autumn, with the last tillages between rows, 8-10 kg/da P_2O_5 и K_2O. During the vegetation, the fungicide Topsin – 0.15% and the insecticide Mospilan – 0.02% were applied to control diseases and pests. To achieve the goal of the study, the following indicators were reported: number of tuft inflorescences, length of flowering stem, number of flower nodes, weight of tuff inflorescences, yield of fresh inflorescences – kg/ha, essential oil content – % and yield of essential oil – kg/ha.

Data obtained for the values of the structural elements, the yield and the essential oil content were statistically processed by the method of dispersion and correlation analyses.

The main climatic factors determining the growth and the productivity of lavender are temperatures and precipitation, their combination and distribution during the growing season (Stanev, 2010).

During the study period 2018-2020, the average daily temperature values exceed the perennial ones, both in the region of Razgrad and in the typical for lavender – Kazanlak and meet the requirements of the culture for heat during the growing season (Figure 1).

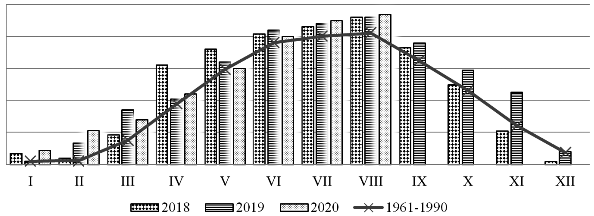

Fig. 1. Average monthly air temperature, °C

The amount of precipitation during the experimental period had values close to, lower or higher than those for the perennial period (Figure 2). During the first experimental year (2018), the precipitation was evenly distributed over months and suitable for the growth of lavender, both for the formation of optimal yields of color and essential oil.

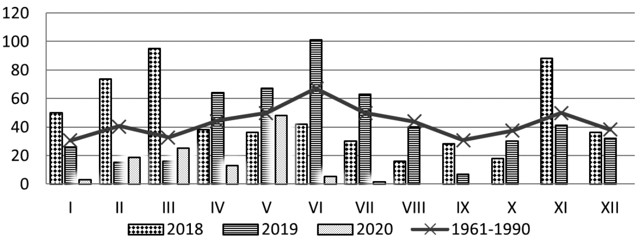

Fig. 2. Rainfall, mm

In 2019, the total amount of precipitation was significantly above the norm. The good moisture storage during the winter months and even distribution of rainfall from the beginning of the growing season to the beginning of flowering had a beneficial effect on the growth of lavender plants and flower yield, while rainfall during flowering and harvesting leads to reduce the quantity and the content of essential oil.

The third year of the study (2020) was characterized by a significantly lower amount of precipitation compared to the previous ones. Poor moisture supply during the winter months, as well as at the beginning of the growing season until the beginning of flowering had a negative effect on the growth of lavender plants and flower yield, while their smaller amount during flowering and harvesting leads to an increase in the essential oil content.

The most favorable of the three years of study was 2018, as the highest yields of flower and essential oil of lavender

Table 1. Effect of some products for foliar application on yield parameters and fresh inflorescences yield of lavender genotype Sevtopolis

		Number of tuft inflorescences	Length of flowering stem, cm	Number of flower nodes	Weight of tuff inflorescences	Yield of fresh inflorescences, kg/ha
Year	2018	838 [c]	23.3 [c]	7.8 [c]	446 [c]	7029 [c]
(A)	2019	705 [b]	20.4 [b]	6.8 [b]	316 [b]	5714 [b]
	2020	600 [a]	14.6 [a]	5.7 [a]	230 [a]	5013 [a]
Variant	Fertigrain foliar	705	19.4	6.6	328	5878
(B)	Amalgerol	702	18.6	6.5	322	5769
	Fertileader vital	730	19.7	7.2	333	5967
	Siapton	748	20.7	7.4	359	6280
	Control	687	18.6	6.2	316	5700
2018	Fertigrain foliar	825 [b]	23.6 [c]	7.6 [b]	442 [b]	6935 [c]
	Amalgerol	830 [c]	22.4 [b]	7.5 [b]	446 [b]	6870 [b]
	Fertileader vital	850 [d]	24.0 [d]	8.0 [c]	453 [c]	7000 [d]
	Siapton	875 [e]	25.0 [e]	8.4 [c]	476 [d]	7500 [e]
	Control	810 [a]	21.7 [a]	7.3 [a]	428 [a]	6840 [a]
2019	Fertigrain foliar	690 [b]	20.0 [b]	6.7 [b]	317 [b]	5780 [c]
	Amalgerol	685 [b]	19.5 [b]	6.2 [b]	300 [b]	5500 [b]
	Fertileader vital	730 [c]	20.5 [b]	7.5 [c]	315 [b]	5800 [d]
	Siapton	740 [d]	21.6 [c]	7.7 [c]	343 [c]	6100 [e]
	Control	680 [a]	19.0 [a]	6.0 [a]	305 [a]	5390 [a]
2020	Fertigrain foliar	600 [c]	14.6 [b]	5.6 [b]	225 [b]	4920 [b]
	Amalgerol	590 [b]	14.0 [b]	5.7 [b]	220 [b]	4936 [b]
	Fertileader vital	610 [d]	14.5 [b]	6.0 [c]	231 [c]	5100 [c]
	Siapton	630 [e]	15.5 [c]	6.1 [c]	257 [d]	5240 [d]
	Control	570 [a]	13.8 [a]	5.2 [a]	215 [a]	4870 [a]
Anova	A	**	**	*	**	**
	B	**	*	*	*	**
	AB	*	n.s	n.s	n.s	*

*Means within columns followed by different lowercase letters are significantly different ($P<0.05$) according to the LSD test

* F-test significant at $P<0.05$; ** F-test significant at $P<0.01$; ns non-significant

were obtained compared to 2019 and 2020. Favorable for flower yield was 2019, and for the content of essential oil 2020.

Results and Discussion

The values of the structural elements of the yield as well as the fresh inflorescences yield were presented in Table 1. The results show that the tested foliar application products help to obtain higher values in all indicators compared to the control variant.

The more favorable climatic conditions in 2018 were a prerequisite for the formation of a larger number of tuff inflorescences compared to the other two experimental years. All treated variants exceed the untreated control by 1.9 to 8.0%. The largest number of tuff inflorescences was reported in Variant 4 – 875 pieces, followed by Variant 3 – 850 pieces, and the smallest – in Variant 1 – 825 pieces. The obtained results were statistically proven. In the second experimental year, the number of tuff inflorescences was on average 18.9% lower than in 2018 and the applied foliar fertilization increased the values of this indicator to 8.8%. The lowest number of tuff inflorescences was reported in the third year of the study (2020) and their number varied from 570 in the control to 630 in Variant 4. The treated variants exceeded the untreated control by 5.3 to 7.1%. On average for the three-year period when treating the plants with Siapton 3 l/ha, the most inflorescences of tuff were formed – 748 pieces, followed by those treated with Fertileader – 3 l/ha, – 730 pieces, and the least in the control variant – 687 pieces. The applied growth regulators increased the values of this indicator to 61 pieces. The analysis of variance (Anova) shows a strong statistically proven influence on both the tested variants (B) and the years with their specific climatic conditions (A). An interaction between Variant and Year was proven.

In the indicator of flower stem length, the results shows that the used products for foliar application increased the values of this indicator to 15.2% in 2018, to 13.7% and 12.3% respectively in 2019 and 2020 compared to the untreated control.

On average for the years of study, in the variant in which the plants were treated with Siapton 3 l/ha, the longest flowering stems were formed 20.6 cm and 18.2 cm for the control. All treated variants were shown to exceed the control from 1.0 to 2.4 cm.

The results of the analysis of variance for the influence of the factors and their interaction on the length of the flowering stem show clear reliable variances, and the interaction between the two factors was statistically unproven.

The density of the class is determined both by the length of the flowering stem and by the number of flower nodes. The number of flower nodes depends on the genotype, but is influenced by meteorological conditions, as well as the application of appropriate agronomic measures in the cultivation of lavender (Stanev, 2010).

As a result of the drought in 2020, a smaller number of flower nodes was formed from 5.2 (Control) to 6.1 (Siapton) for lavender bushes compared to 2019 and 2018 – from 6.0 to 7.7 and from 7.3 to 8.4, respectively. The applied products for foliar treatment increased the number of flower nodes in the lavender variety Sevtopolis to 1.9 and 1.3 pieces, respectively for 2019 and 2020.

On average for the three years of the study, the largest number of flower nodes in lavender variety Sevtopolis were reported in the variant with foliar application of Siapton – 7.4 pieces, followed by the variants Fertileader vital, Fertigrain foliar, and Amalgerol (7.2, 6.6 and 6.5 pieces), and the smallest – Control – 6.2 pieces.

The analysis of variance for the influence of the factors – Variant and Year, as well as their interaction on the indicator "number of flower nodes" shows a significant influence of the factors on the change of the indicator and statistically unproven interaction between them.

An important indicator on which the yield of fresh lavender inflorescences depends is the weight of the tuff flowers. Differences in the climatic conditions during the years of the experiment, as well as the products used for the foliar application, have led to the formation of inflorescences with different weights. The highest values of this indicator were reported in the first experimental year and in the treated variants ranged from 442 to 476 g to 428 g for the control. The weight of the inflorescences had the highest values when applying Siapton and exceeds the control by 11.2%. In 2019 and 2020, the values of this indicator were from 305 g and 215 g in the control to 343 and 257 g in the use of Siapton, respectively. On average for the experimental period, the applied foliar treatment products exceeded the Control by 13.6%, 5.4%, 3.8% and 1.9% for Fertileader vital, Fertigrain foliar and Amalgerol, respectively.

From the analysis of variance for the influence of the factors – Variant and Year, as well as their interaction on the indicator "weight of tuff inflorescences" was reported a reliable influence of the studied factors and not significantly – their interaction.

Data on the influence of foliar application products on the yields obtained depending on the meteorological conditions during the three experimental years show that both the structural elements and the yield of fresh inflorescences increased with the use of foliar fertilizers and biostimulants.

The favorable combination of temperature and humidity during the lavender vegetation was a prerequisite for obtaining a higher yield in 2018 compared to 2019 and 2020.

In the first experimental year, the values of this indicator vary from 6840 to 7500 kg/ha, and the variants in which the plants were treated with growth regulators statistically proven exceed the untreated control from 1.4 to 9.6%.

In 2019, the yield of fresh inflorescences was about 23% lower than the previous year and the treated variants exceed the untreated variant by an average of 7.5%.

In the last year of the experiment, the yield of lavender inflorescences ranged from 4892 to 5240 kg/ha in the treated variants, and for the control – 4870 kg/ha. Mathematical data processing shows that during this less favorable year for yield of fresh inflorescences, the treated variants yield up to 7.6% higher yields compared to the control.

On average for the study period (2018-2020) the highest yield was obtained from variant 4 (6280 kg/ha) in which Siapton was applied – 3 l/ha, followed by variant 3 (5967 kg/ha) – Fertilider vital – 3 l/ha, and the lowest – 5700 kg/ha from the control. All variants treated with growth regulators exceed the untreated one by 1.2 to 10.1%.

The analysis of variance (Anova) shows a strong statistically proven influence on both the tested variants (B) and the years with their specific climatic conditions (A). An interaction between Variant and Year was proven.

The value of inflorescences in the cultivation of lavender is determined by the content of essential oil in them. The values of this indicator were influenced by both the years with different climatic conditions and the products for foliar application (Figure 3).

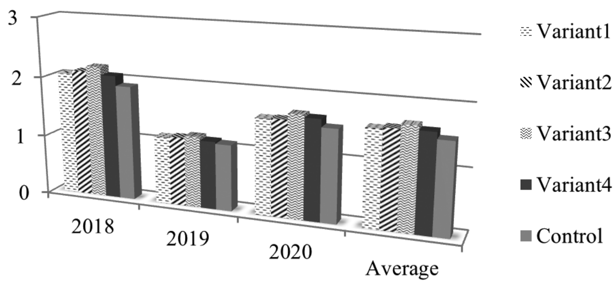

Fig. 3. Effect of foliar fertilizers and biostimulants on essential oil content, %

The lowest values of this indicator were reported in 2019, precipitation during flowering and harvesting were significant and leads to a decrease in the amount of essential oil. The content of essential oil was from 1.12 to 1.18% in the treated variants, and in the control 1.10%, id est from 1.8 to 7.2% higher.

During the first and third experimental years, the content of essential oil in the treated variants compared to the control was from 7.3 to 15.2% and from 3.9 to 11.1%, respectively, higher.

On average for 2018-2020, the values of this indicator in all treated variants exceed the untreated control up to 11.9%, as the highest effect of the foliar fertilization was reported in variant 3, when use Fertilider Vital.

The analysis of variance for the influence of the factors – Variant and Year, as well as their interaction on the indicator "essential oil content" (Table 2) shows a significant influence of the factors on the change of the indicator and statistically unproven interaction between them.

The favorable combination of temperature and humidity in 2018 was a prerequisite for obtaining significantly higher yields of essential oil compared to 2019 and 2020 (Table 3). All treated variants exceed the untreated control from 11 to 24 kg/ha. The highest values of this indicator were reported in the variants 3 and 4 – 154 and 155 kg/ha. The obtained results were statistically proven.

The lowest yields of essential oil were reported in 2019 and ranged from 59 to 69 kg/ha, and in 2020 from 75 to 87 kg/ha. The treated variants exceed the untreated control to 16.9% and 11.6% for 2019 and 2020, respectively.

Table 3. Essential oil yield, kg/ha

	Years of study			Average for the period kg/ha
	2018 kg/ha	2019 kg/ha	2020 kg/ha	
Variant 1	142 [b]	65 [b]	78 [b]	95
Variant 2	145 [b]	63 [b]	79 [b]	96
Variant 3	154 [c]	68 [c]	87 [c]	103
Variant 4	155 [c]	69 [c]	87 [c]	104
Control	131 [a]	59 [a]	75 [a]	88

* Means within columns followed by different lowercase letters are significantly different (P<0.05) according to the LSD test

Table 2. Analysis of variance ANOVA

Source of Variation	Sum of Square	df	Mean Square	F	P-value	F crit
Year**	8.628643	2	4.314322	1247.114	0.00	3.204317
Variant*	0.306993	4	0.076748	22.18516	0.00	2.578739
Interactions [ns]	0.045507	8	0.005688	1.644291	0.14	2.152133
Within	0.155675	45	0.003459			

* F-test significant at P<0.05; ** F-test significant at P<0.01; ns non-significant

Table 4. Analysis of variance ANOVA

Source of Variation	Sum of Square	df	Mean Square	F	P-value	F crit
Year**	72804.9	2	36402.45	2112.328	0.00	3.204317
Variant*	1880.4	4	470.1	27.27853	0.00	2.578739
Interactions *	356.6	8	44.575	2.586557	0.02	2.152133
Within	775.5	45	17.23333			

* F-test significant at P<0.05; ** F-test significant at P<0.01; ns non-significant

Table 5. Values of the coefficient of correlation

	Number of tuft inflorescences	Length of flowering stem	Number of flower nodes	Weight of the flowers per plant	Yield flowers	% essential oil	Yield essential oil
Number of tuft inflorescences	1.00						
Length of flowering stem	0.95	1.00					
Number of flower nodes	0.87	0.89	1.00				
Weight of the flowers per plant	0.98	0.93	0.85	1.00			
Yield flowers	0.98	0.92	0.86	0.98	1.00		
% essential oil	0.52	0.33	0.42	0.56	0.59	1.00	
Yield essential oil	0.76	0.62	0.63	0.78	0.82	0.91	1.00

On average for the three-year period, the treatment of the plants with Siapton 3 l/ha and Fertileader vital were obtained yields of 103 and 104 kg/ha, which exceed the control by 16 kg/ha.

The performed analysis of variance (Table 4) shows a statistically proven influence of both the tested variants (B) and the years with their specific climatic conditions (A). An interaction between Variant and Year was proven.

The correlation analysis between the structural elements, yield of flowers and essential oil, as well as the content of essential oil revealed a very high correlation (r > 0.9) between the following indicators (Table 5): weight of the flowers per plant and number of tuff inflorescences; weight of the flowers per plant and length of flowering stem; length of the flowering stem and number of tuft inflorescences; yield of flowers and number of tuff inflorescences; yield of flowers and length of the flowering stem; yield of flowers and weight of flowers per plant; yield essential oil% and essential oil%.

High positive values of r (r > 0.8) were reported between yield flowers and number of flower nodes; number of flower nodes and number of tuft inflorescences; number of flower nodes and length of the flowering stem; yield flowers and yield essential oil.

Conclusions

The tested products for foliar application increased the productivity and the content of essential oil in the flowers of lavender variety Sevtopolis.

The structural elements of yield, number of tuff inflorescences, length of flowering stem, number of flower nodes, and weight of tuff inflorescences in the treated variants exceed the control up to 8.9%, 11.3%, 19.34% and 13.6% respectively.

On average for the experimental period (2018-2020) the increase in flower yield at the products used for foliar application was in the range from 69 to 580 kg/ha compared to the control variant. The highest yield was reported in the variant treated with the preparation Siapton 3 l/ha – 6280 kg/ha.

Compared to the untreated control in foliar fertilization with the tested products, an increase in the content of essential oil was reported, and the highest values were for the use of the products of Fertilider vital 3 l/ha – 1.69% to 1.51% for the control variant.

On average for the study period, the yield of essential oil had the highest values when using the products Fertileader vital 3 l/ha and Siapton 3 l/ha and exceeds the control by 18.2%.

References

Camen, D., Hadaruga, N., Luca, R., Dobrei, A., Nistor, E., Posta, D. & Sala, F. (2016). Research concerning the influence of fertilization on some physiological processes and biochemical composition of lavender (*Lavandula angustifolia* L.). *Agriculture and Agricultural Science Procedia*, *10*, 198-205.

Chrysargyris, A., Drouza, C. & Tzortzakis, N. (2017). Optimization of potassium fertilization/nutrition for growth, physiological development, essential oil composition and antioxidant activity of *Lavandula angustifolia* Mill. *Journal of Soil Science and Plant Nutrition*, *17(2),* 291-306.

Giannoulis, K. D., Evangelopoulos, V., Gougoulias, N. & Wogiatzi, E. (2020). Could bio-stimulators affect flower, essential oil yield, and its composition in organic lavender (*Lavandula angustifolia*) cultivation? *Industrial Crops and Products*, *154*, 112-611.

Jelačić, S., Kišgeci, J., Beatović, D., Moravčević, Đ. & Bjelić, V. (2008). The use of biostimulators and slow decomposing fertilizer with different ways of lavander seedlings production. In: *Proceedings of the Fifth Conference on Medicinal and Aromatic Plants of Southeast European Countries,(5th CMAPSEEC), Brno, Czech Republic,* 2-5 September, 2008, Mendel University of Agriculture and Forestry in Brno.

Minev, N. (2020). Effect of foliar fertilization on the yield and quality of lavender (*Lavandula angustifolia* Mill.). *Journal of Mountain Agriculture on the Balkans*, *23(2),* 248-261.

Mirrabi, H., Abbaszadeh, B. & Akbarzadeh, M. (2014). The effect of chemical and biological fertilizers on flower yield, leaf yield and essential oil of lavender (*Lavandula angustifolia*). *Journal of Medicinal Plants and By-products 1,* 85-87

Nickell, L. G. (1982). Plant growt regulators. Agricultural uses, Springer – Verlag, Berlin, Heidelberg, New York.

Rafiee, H., Naghdi Badi, H., Mehrafarin, A., Qaderi, A., Zarinpanjeh, N., Sekara, A. & Zand, E. (2016). Application of plant biostimulants as new approach to improve the biological responses of medicinal plants-A critical review *Journal of Medicinal Plants, 3(59),* 6-39.‌

Silva, S. M., Luz, J. M. Q., Nogueira, P. A. M., Blank, A. F., Sampaio, T. S., Pinto, J. A. O. & Junior, A. W. (2017). Organo-mineral fertilization effects on biomass and essential oil of lavender (*Lavandula dentata* L.). *Industrial Crops and Products*, *103*, 133-140.

Skipor, O. B., Savchenko, M. V. & Umanets, N. N. (2018). Efficiency of different plant growth stimulants in the technology of growing narrow-leaved Lavender under the conditions of the foothill zone of the Crimea. *Taurida Herald of the Agrarian Sciences, Volume 2(14),* 110-117.

Stanev. S. (2010). Evaluation of the stability and adaptability of the Bulgarian lavender (*Lavandula angustifolia* Mill.) sorts yield. *Agricultural Science and Technology, 2 (3),* 121–123.

Stanev, S. & Dzhurmanski A. (2011). Guidelines for selection of lavender (*Lavandula angustifolia* Mill.) *Science & Technologies, 1 (6),* 190-195.

Yanchev, I. (2017). Productivity and quality of bulgarian lavender variaties. *Scientific Papers, Series A., Agronomy, LX,* 440-442.

Yasemin, S., Ozkaya, A., Koksal, N. & Gok, B. (2017). The effect of nitrogen on growth and physiological features of lavender. *3rd International Congress on Medicinal and Aromatic Plants, October – 02-03, Kuala Lumpur, Malaysia*, 746-754.

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