STUDIES ON THE INFLUENCE OF SOME REGULATING GROWING SUBSTANCES UPON THE QUANTITY AND QUALITY OF *MENTHA PIPERITA* PRODUCTION

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Abstract

Mentha piperita, an important medicinal plant due to its volatile oil content and especially its main component, menthol, is cultivated at present on small surfaces. Out of the wish to increase the production of mint we resorted to phyto-regulating growing substances. The biometric determinations were effectuated in the period on vegetative growth and the inflorescence phase. We followed the quantitative differences as compared to the blank test, for each more important vegetative organ and for the entire plant. In 2008, we studied the effect of some bio-regulating growing substances on mint. We noticed some substances with a benefic role upon the increase of mint production.

Key words: bio-regulating growing substances, influence on production

INTRODUCTION

Mint (*Mentha Piperita*) is a natural remedy known and appreciated for centuries. It seems it was very popular for Greeks and Romans. [1] Mint contains a high level of essential active oil called menthol. [8] Mint is used successfully in the gastro-intestinal disorders, [4] maintains the health of liver and works wonders in case of indigestions and vomiting states. [2]

Mint was and still is considered by many researchers and cultivators as a perennial plant due to the lack of coincidence between the period of growth of aerial stems and the subterranean stolons. [2, 3]

Researches confirm that the mint left on the same place, without any agricultural work for two years, may give productions of green mass that always exceed the annual productions obtained for mint, but this is of an inferior quality. [5]

The mint maintained for several years on the same place leads to a unilateral weakness of soil, excessive weeding, especially with perennial plants, the increase of diseases and pests and an annual loss of at least 80-120 g stolons/ha, what considerably reduces the possibilities of extension of this culture.

The phyto-regulating growing substances used in this experiment were from the group of auxins, gibberellins, cytokinins and retarding substances. [6,7]

MATERIAL AND METHOD

In 2008, in an experimental field, we followed the effect of some bio-regulating growing substances on mint.

The treatment was applied on April 15th by sprinkling with 1000 l solution/ha [9] calculated for each variant (parcel has 2x2 m=4 m^2 and is repeated for 3 times)

Thus, we used:

- Auxins - indole acetic acid
- Gibberellins - gibberellic acid
- Cytokinins - 6-benzyl adenine
- Retarding substances - cycocel and ethrel

Auxins

They were the first bioactive substances discovered. In extremely small doses they affect the growing and development of plants (formation of vegetative and generative organs).

The chromatographic methods highlighted the presence of Auxins in roots, stems, seeds and fruits under the form of complex mixtures of regulating substances with a stimulating or inhibiting role depending on the existing quantity.

Natural and synthetic auxins exercise different physiologic actions followed by a series of particular reactions of growing, development and metabolism in plants (cytological modifications, biophysical modifications at cellular level, changes in the cellular metabolism, in the seed germination and plant growing, formation of buds and inflorescence fecundation and fruit formation, falling of fruits and leaves. [6, 7]

In the experiment on mint we used the most active synthetic auxin.

- **A.I.A (indole acetic acid).**

Gibberellins

By biological tests, we identified natural gibberellins in many species of horticultural plants.

There are a large number of gibberellins, but the most studied compound and the most active in the stimulation of different physiological processes of plants is gibberellin X or gibberellic acid.

Gibberellins intervene in the process of cellular division, stimulation of seed germination, stimulation of growing processes, defeat of nanism phenomenon, modification of apical dominance, stimulation of inflorescence and fruit growing, modifications in plant metabolism, intensifies photosynthesis even right after treatment.[6, 7] In mint treatment we used the **gibberellic acid**.

Cytokinins

They are substances that in low concentration stimulate the cellular division.

Endogenous cytokinins derive from the degradation of the nucleic acids going through certain phases.

We synthesized numerous chemical substances exercising similar properties to the endogenous ones.

The effects of endogenous and exogenous cytokinins on plants are explained by their direct action on the nucleic acids, in the stimulation of the ribonucleic acid synthesis and as a depressor of genes by inhibiting the activity of certain enzymes.

Cytokinins stimulate the cellular divisions and extension, differentiation and formation of plant organs, the stopping of aging processes in plants, physiological modifications. [6,7] In the experiment we used **6-benzyl adenine.**

Retarding substances

They are substances guide the processes of growing, development and fruit growing of plants. They play an important role in reducing the division and cellular elongation processes from growing stem and offshoot tissues, and in this way they regulate the plant height, the length of aerial lateral ramifications, the rhythm of formation and elongation being stopped for a while. By their action particularities, the retarding substances are clearly different from the group of growing stimulators, though in most cases, they stimulate inflorescence and determine important increases of production. They are also different from the group of inhibiting substances because they block irreversibly the vital metabolic processes of plants, they do not cause malformations at the level of different vegetative and reproductive organs and the viability of the entire plant is not diminished.

Physiological action of retardants

Modification of anatomic-morphologic characters of plants, inflorescence, modification of the rhythm of metabolic processes. [6,7]

Among retardants, we used in our experiment:

- **Cycocel** (chlorcoline chloride)
- **Ethrel** (acid phosphonic)

The experimental diagram used was the Latin rectangle of the type 6x3x1, with 6 variants, 3 repetitions and a series. (Table 1)

The following variants resulted:

V1 – blank test (control)
V2 – variant treated with indole acetic acid (A.I.A.)
V3 – variant treated with gibberellic acid
V4 – variant treated with 6-benzyl adenine
V5 – variant treated with cycocel
V6 – variant treated with ethrel

Table 1
Randomized arrangement of variants (to eliminate soil differences)

R III	**V5**	**V6**	**V1**	**V2**	**V3**	**V4**
R II	V3	V4	V5	V6	V1	V2
R I	V1	V2	V3	V4	V5	V6

The calculation of the experimental results was made according to the method of variance analysis for the plant production.

We calculated the average productions for each variant (x), variant (s^2) and the standard deviation of difference (s_d).

On the basis of these parameters, we established the significance of the limit difference (DL) linked with the transgression probabilities (P 5%, P1% and P 0,1%) and the freedom degrees of expriment:

- GL_B – number of repetitions
- GL_V – number of variants
- GL_T – total number of parcels
- GL_E – error
- $GL_E = GL_T-(GL_B+GL_V)$

Te biometrical determinations were effectuated both in the filed and in the lab in the period of vegetative growing and in the inflorescence phase. We followed the quantitative differences as compared to the blank test, for each important vegetative organ and the entire plant. The treatments effectuated in amount of 100 l/ha were calculated for each variant.

RESULTS AND DISCUSSIONS

The highest production of fresh leaves was registered fr the variant treated with gibberellic acid. Higher values than the blank test were registered for the variants treated with A.I.A. and 6-benzyl adenine. Cycocel and Ethrel inhibited the vegetative growing, thus obtaining smaller values than the blank test.

We also notice that for DL 0.3% production is almost 80% higher than the blank test. (table 2)

Table 2
Effect of growing substances on the fresh leaf production for *Mentha piperita*

No var.	Variant		Kg/ha	% from blank test	Difference from blank test	Signification
	Substances	Concentration ppm				
1	Blank test	-	7830	100.0	-	
2	A.I.A.	10	8580	109.6	+ 750	+
3	Gibberellic acid	100	9445	120.6	+ 1615	+++
4	6-benzyl adenine	5	8925	114.0	+ 1095	++
5	Cycocel	2500	7080	90.4	- 50	0
6	Ethrel	100	7485	95.6	- 45	
DL 5%			680	86.8		
DL 1%			967	123.5		
DL 0,3%			1400	178.8		

Sd= 305

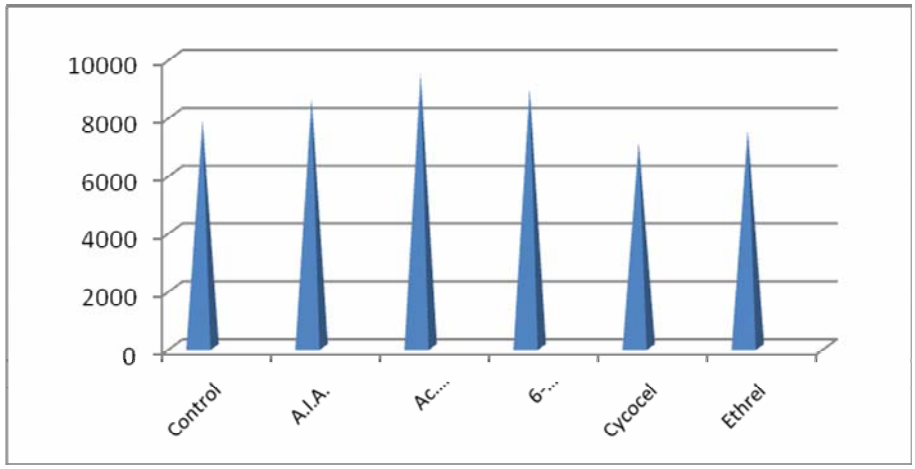

Fig.1. Effect of growing substances on the fresh leaf production for *Mentha piperita*

As in the case of leaf production, the plant production is superior as compared to the blank test for the variants treated with gibberellic acid, A.I.A. and 6-benzyl adenine, and Cycocel and Ethrel inhibited the vegetative growing. (tab. 2)

For DL 0.1% production increased by almost 50%.

Table 2
Influence of growing substances on the plant production for *Mentha piperita*

No var.	Variant		Kg/ha	% from blank test	Difference from blank test	Signification
	Substances	Concentration ppm				
1	Blank test	-	14350	100.0	-	
2	A.I.A.	10	15690	109.3	+1340	+
3	Gibberellic acid	100	17425	121.4	+3075	+++
4	6-benzyl adenine	5	16250	113.2	+1900	++
5	Cycocel	2500	12835	89.4	-1515	00
6	Ethrel	100	13575	94.6	-775	
DL 5%			1026	71.5		
DL 1%			1468	101.6		
DL 0,1%			2111	147.1		

Sd= 460
No. of blocks = 3
No. of variants = 6
GLT = 18-1=17
GLB = 3-1=2
GLV = 6-1=5
GLE = GLT-(GLB+GLV)=17-(2+5)=10
P 5% (for GLE=10) = 2.23
P1% = 3.17
P 0,1% = 4.59

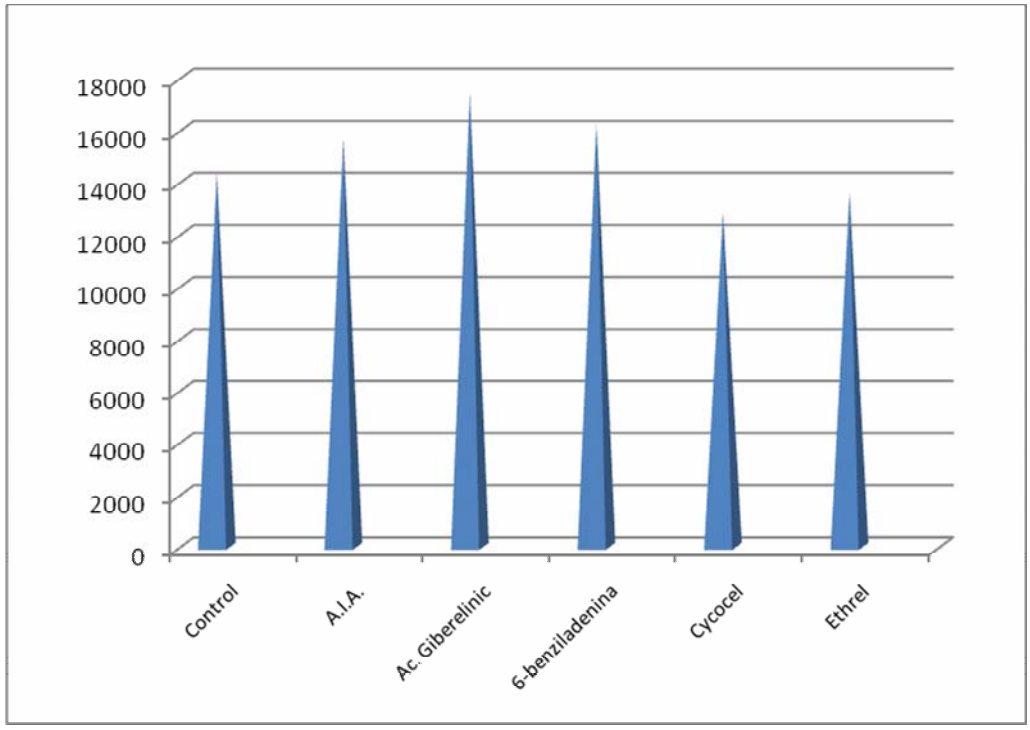

Fig. 2. Influence of growing substances on the plant production for *Mentha piperita*

For all the parameters analyzed, it is confirmed that the gibberellic acid has the role of stimulant for growing, followed by 6-benzyl adenine and A.I.A., whereas Ethrel and Cycocel are inhibitors.

Table 3
Action of growing substances on the components of fresh mass production for *Mentha pipierita*

No var	Variant		Leaves		Inflorescence		Stems		Total plants	
	Substance	Conc ppm	Kg/ha	% from blank test	Kg/ha	% from blank test	Kg/ha	% from blank test	Kg/ha	% from blank test
1	Blank test	-	7830	100.0	905	100.0	5615	100.0	14350	100.0
2	A.I.A.	10	8580	109.6	995	109.9	6115	108.9	15690	109.3
3	Gibberellic acid	100	9445	120.6	1080	119.3	6900	122.9	17425	121.4
4	6-benzyl adenine	5	8925	114.0	1005	111.0	6320	112.8	16250	113.2
5	Cycocel	2500	7080	90.4	845	93.4	4910	87.4	12835	89.4
6	Ethrel	100	7485	95.6	885	97.8	5205	92.7	13575	94.6
Average			8224		952		5844		15020	
			54.8%		6.3%		38.9%		100%	

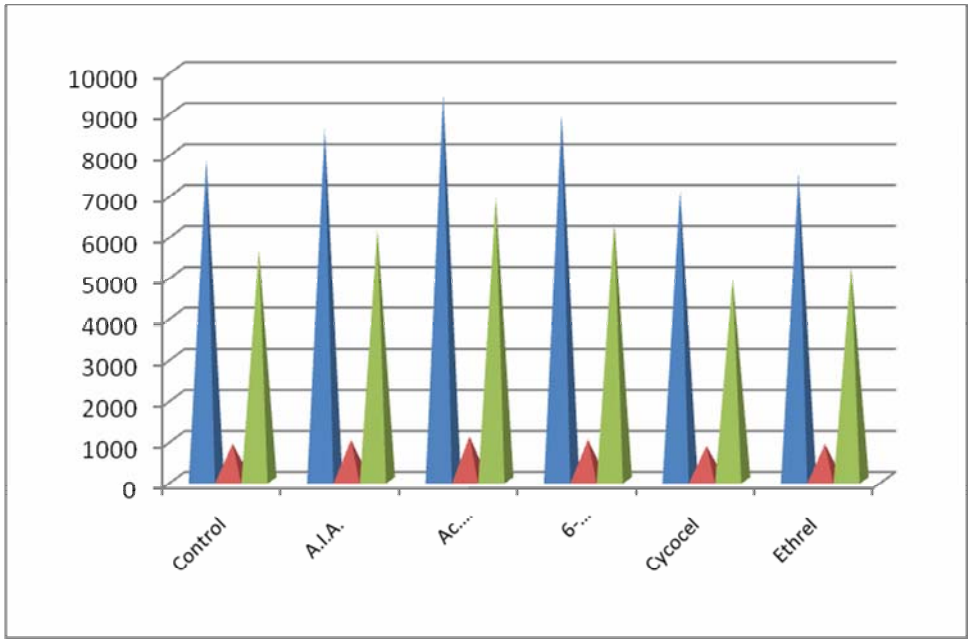

Fig. 3 Action of growing substances on the components of fresh mass production for *Mentha piperita*

CONCLUSIONS

In the case of mint, for all the parameters analyzed, it is confirmed that the gibberellic acid stimulates growing, followed by 6-benzyl adenine and A.I.A., whereas Ethrel and Cycocel are inhibitors.

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