

## The effect of Atonik AL application on growth and development of motherwort (*Leonurus cardiaca* L.) depending on age of plant

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**Abstract.** In the paper there are described the effects of foliar application of Atonik AL (0.2% solution) on the growth and development of motherwort (*Leonurus cardiaca* L.) plants in the first, second and third year of vegetation. The experiment was performed in years 2001–2004 on brown sandy loam soil. 1-year-old plants were sprayed twice (at seeding and three weeks later); 2-year and 3-year-old – three times: at rosette stage, three weeks later and after first harvest. In the experiment there were stated beneficial effects of the preparation on plants morphological features, especially in the first and second year of vegetation (stems were higher thicker, more branched and they produced longer inflorescences). Beneficial influence of Atonik on the growth and development plants resulted in significant increase of air dry mass of 1- and 2-year-old plants. In case of 3-year-old plants positive effect of Atonik regarded only height of plants and length of inflorescence.

**key words:** *Leonurus cardiaca*, Atonik, plant growth and development

### INTRODUCTION

According to the producer, Atonik AL is an universal plant growth stimulator; active substances are sodium ortho- and para-nitro-phenolate and sodium 5-nitro-guaiaculates. The preparation increases absorption of mineral compounds and regulates concentration of  $\text{Ca}^{2+}$  ions in plants cells, speeding up synthesis of organic compounds and accelerates plant growth and development.

Motherwort (*Leonurus cardiaca* L.) is a perennial medicinal plant, demonstrating sedative and soporific properties (Mścisz, Gorecki, 1997). Research on the effects of Atonik on other medicinal plants indicate usefulness of this preparation (Berbec et al., 2003; Kołodziej, Berbec, 2005).

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The aim of this investigation was to determine the effect of Atonik AL on the growth and development of motherwort plants during three successive years of vegetation.

### MATERIAL AND METHODS

The experiment was carried out in 2001–2004 on the brown loamy-sand soil. Every year new plantation was established and effects for one- and two-year-old plants were received during 3 years, while results concerning three-year-old plants refer to two year lasting experiment. Seedlings were produced in greenhouse (seeds were sown at the end of March in multi-cell trays filled with peat origin substrate). Seedlings were planted on field at phase of 6–8 leaves (beginning of May) in distance of 50 x 30 cm (plots area – 16 m<sup>2</sup> in 4 replications). Soil fertilization was performed as recommended for this species (N – 80 kg, P – 21.8 kg, K – 66.4 kg per hectare) (Załęcki et al., 1994). Atonik AL was applied in 0.2% solution in quantity of 400 litres per hectare (each spraying). 1-year-old plants were sprayed twice: at the end of May and in 16<sup>th</sup>–20<sup>th</sup> of June. 2- and 3-year-old plants were sprayed 3 times: at rosette stage (April/May), three weeks later and after first harvest (on regrowth). Plants were harvested in blooming phase (in first year – one harvest, in following years – two harvests: half of June and late August). Before harvest, height of plants, stem thickness, number of branches and inflorescence length were measured. For 2- and 3-year-old plants additionally number of stems was calculated. After harvest, air dry mass of plants was determined. Numerical data were statistically worked out and the least significant differences were calculated with Tukey's test at 5% error margin.

### RESULTS AND DISCUSSION

Beneficial effect of Atonik on plant growth and development was proved irrespectively of plant age, although effectiveness of the preparation declined along with age of

Table 1. Effect of Atonik on features of motherwort plants (first harvest)

Objects	Height of plants [cm]	Number of stems (per plant)	Number of branches (per stem)	Thickness of stem [mm]	Length of inflorescence [cm]	Air dry mass of plant [g]
1-year-old plants						
Control	82.4	-	20.2	6.5	22.9	35.4
Atonik	97.2	-	23.2	6.9	28.6	47.7
<b>Mean</b>	<b>89.9</b>	-	<b>21.7</b>	<b>6.7</b>	<b>25.3</b>	<b>41.6</b>
LSD (0.05)	5.27	-	0.70	0.14	1.71	8.46
2-year-old plants						
Control	125.9	9.8	12.1	6.6	12.1	84.2
Atonik	143.3	11.5	11.1	6.9	14.9	115.6
<b>Mean</b>	<b>134.6</b>	<b>10.7</b>	<b>11.6</b>	<b>6.8</b>	<b>13.5</b>	<b>99.9</b>
LSD (0.05)	4.34	0.88	0.55	0.10	1.53	7.94
3-year-old plants						
Control	97.1	11.8	9.2	5.5	9.7	63.2
Atonik	105.9	10.6	9.8	5.4	10.9	58.8
<b>Mean</b>	<b>101.5</b>	<b>11.2</b>	<b>9.5</b>	<b>5.5</b>	<b>10.3</b>	<b>61.0</b>
LSD (0.05)	6.28	1.10	ns	ns	0.44	ns

ns – not significant

Table 2. Effect of Atonik on features of motherwort plants (second harvest)

Objects	Height of plants [cm]	Number of stems (per plant)	Number of branches (per stem)	Thickness of stem [mm]	Length of inflorescence [cm]	Air dry mass of plant [g]
2-year-old plants						
Control	56.4	18.8	6.2	2.9	8.7	27.8
Atonik	60.6	28.0	7.2	2.9	11.2	41.6
<b>Mean</b>	<b>58.5</b>	<b>23.4</b>	<b>6.7</b>	<b>2.9</b>	<b>9.9</b>	<b>34.7</b>
LSD (0.05)	4.07	2.17	0.48	ns.	2.01	5.07
3-year-old plants						
Control	56.1	19.3	5.8	3.0	8.5	31.7
Atonik	57.1	27.9	7.2	2.8	9.6	31.1
<b>Mean</b>	<b>56.6</b>	<b>23.6</b>	<b>6.5</b>	<b>2.9</b>	<b>9.1</b>	<b>31.4</b>
LSD (0.05)	ns	2.23	0.49	ns	ns	ns

ns – not significant

the plants. In the first year of vegetation Atonik showed the biggest influence on all examined morphological features: plant height, thickness of stems and their branching as well as length of inflorescence (Table 1). In the second year positive effect of the preparation concerned almost all examined features (exception was number of branches during first harvest and thickness of stems during second one) (Table 1 and 2).

In the third year of vegetation (3-year-old plants) spraying with Atonik had the smallest effect, resulted however in an increased height of plants and length of inflorescence (only during first harvest) and also in increased number of stems and branches (during second harvest) (Table 1 and 2). As regards stem thickness – Atonik resulted in an increase of 1- and 2-year-old plants (only the first harvest). In

general, thickness of stems during first harvest was almost twice bigger than those of second one.

Advantageous effects of Atonik in culture of medicinal plants were recorded in experiments of other authors. Kołodziej (2001) got increase of stem number in curlycup gumweed, Gruszczyk and Berbeć (2004) found increased height of feverfew plants, Berbeć et al. (2003) – common thyme.

As regards the effect of Atonik on mass of particular plants, it was significant in case of 1- and 2-year-old plants (increase respectively by 35% and 37–50%). From among features examined, height of plants and number of branches (in the first year of vegetation) and also number of stems (in case of 2-year-old plants) chiefly contributed to the increased mass of plants. In the third year of vegeta-

tion (3-year-old plants) Atonik did not affect markedly air dry mass of plants. In experiments with others perennial medicinal plants: feverfew and goldenrod, Atonik brought about a significant increase of mass of plants irrespectively of plant age (Gruszczyk, Berbeć, 2004; Kołodziej, 2008).

#### CONCLUSIONS

1. The effect of spraying motherwort plants with 0.2% Atonik AL solution, on plant growth and development was especially marked in the first and second year of vegetation. It resulted in the increase of stem height and their thickness, length of inflorescence and number of stems (in second year of vegetation).

2. Along with plant age, the effect of spraying declined and was more apparent during the first harvest than in second one. Nevertheless it was still effective for such characters as height of plants, inflorescence length and number of branches.

3. Positive influence of Atonik on plant growth resulted in significant increase of air dry mass of plants in the first (about 35%) and second (37–49%) year of vegetation.

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