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## RESEARCH ON THE INFLUENCE OF SOME TECHNOLOGICAL SEQUENCES ON THE PRODUCTIVITY OF THE LOPHANTUS SPECIES (*LOPHANTUS ANISATUS*) IN THE PEDO–CLIMATIC CONDITIONS OF CENTRAL MOLDOVA

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**Abstract:** The present paper presents data on the influence of technological sequences at *Lophanthus anisatus* species cultivated under the conditions of A.R.D.S. Secuieni in the period 2019–2020. The average production of fresh herb was between 15229 kg/ha in the second epoch and 14318 kg/ha in the fourth epoch of sowing. The average seed production per hectare ranged between 144 kg/ha for the control variant and 223 kg/ha for the variant sown at 70 cm between rows and 15 cm between plants/row. A.R.D.S. (Agricultural Research and Development Station) Secuieni is known for the introduction into culture in order to develop the cultivation technologies of different species of medicinal plants, thus becoming a necessity nowadays.

**Keywords:** lophanthus, seed, dry herb, fresh herb

### 1. INTRODUCTION

In the world is known under several names (*Agastache Foeniculum*, *Lophanthus Agastache*) or *lophant popular* (Luchian et al., 2020; Popescu C., 2017; Vînătoru et al., 2015). *Lophanthus anisatus* Benth is a herbaceous perennial of the Lamiaceae family (Ivanov et al., 2019), a valuable medicinal edible and technical crop, native to Asia (Vînătoru et al., 2019).

The plant is drought-resistant, does not like waterlogging, but needs a sufficient amount of water during the first year of cultivation. The chemical composition of *Lophanthus anisatus* (alkaloids, caffeic acid, phenolic compounds, anethole, estragole, minerals and vitamins) gives it antibacterial (Zielinska and Matkowski, 2014), antifungal (Hashemi et al., 2017; Zielinska and Matkowski, 2014), antiviral, anti-inflammatory (Costache and Vînătoru, 2017; Duda et al., 2013) and antipyretic properties (Shanaida et al., 2020), being used in cardiovascular, neurological, digestive disorders (Duda et al., 2013; Costache and Vînătoru, 2017). This species can be grown in parks and planters as a decorative plant, highlighted by its beautifully colored inflorescences in purple blue, covering a long period of flowering, from June until the arrival of frost (Korablyova O. A., 2012; Nazarenko L. G., 2008). In many world cuisines *Lophanthus anisatus* Benth. – is an irreplaceable herb.

Fresh and dried young shoots are used for baked products, as a component of spicy compositions and condiments for various dishes, as a flavoring for vodka, added to compotes, jelly, mousses, and puddings. The spice is added to stewed, baked dishes and fried fish, meat and salads (Kormosh et al., 2020). *The purpose of this work was to introduce this species into the culture in order to develop the cultivation technology.*

### 2. MATERIALS AND METHODS

The researches were carried between 2019 and 2020 at A.R.D.S. Secuieni on a typical cambic soil type. Characterized as being well supplied with mobile phosphorus (39 ppm – P<sub>2</sub>O<sub>5</sub>), moderately supplied in nitrogen with the soil nitrogen index of 2.1, well supplied in mobile potassium (161 ppm – K<sub>2</sub>O), slightly acidic, with the pH (in aqueous suspension) of 6.29 and a humus content of 2.3%.

In the conditions of A.R.D.S. Secuieni we experimented four sowing epochs: V<sub>1</sub> (control) – sown in the first decade of April; V<sub>2</sub> – sown in the second decade of April; V<sub>3</sub> – sown in the third decade of April; V<sub>4</sub> – sown in the first decade of May. At *Lophanthus anisatus* species, the aim was to establish a technological



Figure 1. *Lophanthus anisatus*

link through the establishment of the optimal nutritional space in a bifactorial experience according to the subdivided parcel method in three repetitions.

Experienced factors are: A – the distance between rows with graduations:  $a_1$  – 25 cm,  $a_2$  – 50 cm and  $a_3$  – 70 cm and B – the distance between plants per row with graduations:  $b_1$  – 15 cm,  $b_2$  – 25 cm and  $b_3$  – 35 cm.

The soil work and the preparation of the germination bed consisted in releasing the soil from the plant debris in the pre-planting stubble-turning and plowing at a depth of 30 cm. In spring preparation of the germination bed was made with a harrow disc and the sowing was done manually at a depth of 1 cm. The year 2019 was characterized as being warm in terms of temperatures and dry in terms of the annual amount of precipitation, which was unevenly distributed during the vegetation period of the plants (table 1 and 2).

Table 1. Temperatures recorded at A.R.D.S. Secuieni meteorological station

Average temperature °C	Months						Average vegetation period
	Apr	May	Jun	Jul	Aug	Sept	
2019	9.7	15.3	21.3	20.1	21.2	16.2	17.3
2020	10.0	13.9	20.0	20.9	22.2	18.0	17.5
Multiannual average	9.5	15.4	18.8	20.4	19.5	15.0	16.4

The spring of 2020 was characterized as being dry from a thermal and pluviometric point of view. The month of June was warmer, recording a deviation of 2.5 °C from normal. From a pluviometric point of view, a significant deficit was recorded in April, of 46 mm, thus complicating the work of preparing the seed bed (table 1 and 2).

Table 2. Rainfall recorded at A.R.D.S. Secuieni meteorological station

Rainfall (mm)	Months						Sum for the vegetation period
	Apr	May	Jun	Jul	Aug	Sept	
2019	38.0	95.0	55.8	46.6	20.4	64.8	320.6
2020	1.2	69.6	72.6	39.0	51.2	60.4	294.0
Multiannual average	46.9	65.7	85.0	82.3	60.2	45.7	385.8

### 3. RESULTS

Following the determinations performed on the *Lophantus anisatus* (lophantus) species, it was found that the average production of fresh herb was between 15229 kg/ha in the second epoch and 14318 kg/ha in the fourth epoch. Compared to the control a statistically significant positive increase in production was obtained for the variant sown in the second epoch (291 kg/ha) (table 3).

Table 3. The herb production obtained from lophantus in the period 2019–2020

Variant	Average fresh herb production (kg/ha)				Average dry herb production (kg/ha)				Ratio (fresh/ dry)
	Kg/ha	%	Diff. (Kg/ha)	Sign.	Kg/ha	%	Diff. (Kg/ha)	Sign.	
V1	14938	100	Ct.		7286	100	Ct.		2.03:1
V2	15229	101.95	291	*	8047	110.44	761	***	1.89:1
V3	14706	98.44	-233		7321	100.48	35		2.01:1
V4	14318	95.85	-620	000	6911	94.85	-375	00	2.06:1
	LSD 5% – 253.86 kg/ha LSD 1% – 384.42 kg/ha LSD 0.1% – 617.56 kg/ha				LSD 5% – 229.82 kg/ha LSD 1% – 348.01 kg/ha LSD 0.1% – 559.07 kg/ha				

Table 4. The seed production obtained from lofantus in the period 2019–2020

Variant	Average seed production (kg/ha)			
	Kg/ha	%	Diff. (kg/ha)	Sign.
V1	184	100	Ct.	
V2	219	119.02	35	***
V3	173	94.20	-11	
V4	153	82.88	-32	000
	LSD 5% – 13.05 kg/ha; LSD 1% – 19.77 kg/ha; LSD 0.1% – 31.76 kg/ha			

The average production of dry herb in the second epoch was 8047 kg/ha, the difference being positive, very significant compared to that obtained in the first epoch (control) of 7286 kg/ha (table 3).

The ratio of fresh herb production to dry herb production was between 2.06 in the fourth epoch of sowing and 1.89 in the second epoch of sowing (table 3).

Compared to the control variant in which the production was 184 kg/ha, in the second epoch was a production increase of 35 kg/ha interpreted as positive very significant (table 4).

The interaction of the studied factors influenced the average fresh herb production at lophantus. Compared to the control variant  $a_1 \times b_1$  (14643 kg/ha), production increases were obtained in most experimental variants between 170 – 602 kg/ha, being statistically assured and interpreted as positives distinct and very significant (table 5).

Also the average dry herb production was influenced by the interaction of the studied factors (distance between rows and distance between plants per row). Compared to the control variant  $a_1 \times b_1$  (7229 kg/ha), production increases between 170 – 407 kg/ha were achieved significant, distinctly significant and very significant (table 6).

Table 5. The influence of the interaction between the distance between rows and the distance between plants per row on the average fresh herb production at lophantus in the period 2019–2020

Distance between rows (A)	Distance between plants / row (B)	Average fresh herb production (kg/ha)	%	Diff.	Sign.
a1–25 cm	b1–15 cm	14673	100	Mt.	
	b2–25 cm	14742	100.47	69	
	b3–35 cm	14843	101.16	170	**
a2–50 cm	b1–15 cm	14895	101.51	222	**
	b2–25 cm	14933	101.77	260	**
	b3–35 cm	15175	103.42	502	***
a3–70 cm	b1–15 cm	15275	104.10	602	***
	b2–25 cm	15225	103.76	552	***
	b3–35 cm	15033	102.46	360	***
LSD5% – 99.44 kg/ha; LDS1% – 164.35 kg/ha; LSD 0.1% – 304.5 kg/ha					

The average seed production per hectare ranged between 144 kg/ha for the control variant and 223 kg/ha for the variant sown at 70 cm between rows and 15 cm between plants/row.

Statistically assured and interpreted significant and distinctly significant production increases were obtained at a distance of 50 cm and 70 cm between rows at all three distances between plants per row (table 7).

Table 6. The influence of the interaction between the distance between rows and the distance between plants per row on the average dry herb production at lophantus in the period 2019–2020

Distance between rows (A)	Distance between plants / row (B)	Average dry herb production (kg/ha)	%	Diff.	Sign.
a1–25 cm	b1–15 cm	7229	100	Mt.	
	b2–25 cm	7357	101.78	128	
	b3–35 cm	7399	102.35	170	*
a2–50 cm	b1–15 cm	7350	101.67	121	
	b2–25 cm	7489	103.60	260	**
	b3–35 cm	7385	102.16	156	
a3–70 cm	b1–15 cm	7401	102.37	172	*
	b2–25 cm	7636	105.63	407	***
	b3–35 cm	7006	96.91	–223	0
LSD5% – 163.2 kg/ha; LSD1% – 234.6 kg/ha; LSD 0.1% – 400.9 kg/ha					

Table 7. The influence of the interaction between the distance between rows and the distance between plants per row on the average seed production at lophantus in the period 2019–2020

Distance between rows (A)	Distance between plants / row (B)	Average seed production (kg/ha)	%	Diff.	Sign.
a1–25 cm	b1–15 cm	144	100	Mt.	
	b2–25 cm	158	109,72	14,00	
	b3–35 cm	169	117,36	25,00	
a2–50 cm	b1–15 cm	181	125,92	37,33	*
	b2–25 cm	190	132,17	46,33	**
	b3–35 cm	208	144,67	64,33	**
a3–70 cm	b1–15 cm	194	134,49	49,67	**
	b2–25 cm	223	154,62	78,67	**
	b3–35 cm	190	131,94	46,00	**
LSD5% – 26,4 kg/ha; LSD1% – 41,9 kg/ha; LSD 0,1% – 79,6 kg/ha					

#### 4. CONCLUSIONS

*Lophanthus anisatus* is an aromatic plant considered among the first four melliferous plants in the world. From *Lophanthus anisatus*, is used all the aerial part with multiple uses, the plant not having especial soil demands and presenting an increase resistance to illnesses and pests.

*Lophanthus anisatus* is used in natural medicine having numerous medicinal properties, such as: prevents and treats gastritis, gall–bladder affection, hepatisis, cerebral vascular accidents, increases body immunity, balances the metabolic processes. The highest seed production (219 kg/ha) was obtained in the second sowing season (second decade of April).

The interaction of the studied factors influenced the production of dry herb obtaining the highest production at the variant sown at 70 cm between rows and at 25 cm between plants per row (7636 kg/ha).

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