

INFLUENCE OF CULTIVATION SYSTEMS ON PRODUCTION AND CONTENT OF HEAVY METALS IN EGGPLANT

INFLUENȚA SISTEMELOR DE CULTIVARE ASUPRA PRODUCȚIEI ȘI CONȚINUTULUI DE METALE GRELE LA PĂTLĂGELELE VINETE

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Abstract: *The present paper was carried out in the Vegetable research field of the "V. Adamachi" Farm regarding the interaction of eggplant cultivars with fertilization regime. The determination of the heavy metal content was carried out by atomic absorption spectrophotometry, using the Shimadzu GC-2100.*

Following the conduct of the analyses, they were detected in both conventional and organic cultivation systems, both in soil and in vegetables, containing CR, Ni, with, Zn, Cd and Pb. The CR, Ni, and Zn content of the conventional system exceeded the maximum permissible limit By Regulation EC No 1/2003. 396/2005, whereas the heavy metal content of the organic system has not exceeded for any chemical element the maximum limits permitted by Regulation EC No 1/2003. 396/2005.

Key words: eggplant, fertilizers, yield, heavy metals

Rezumat: *Lucrarea de față s-a realizat în câmpul de cercetare legumicol al fermei „V. Adamachi” din Iași și urmărește interacțiunea cultivarelor de pătlăgele vinete cu regimul de fertilizare. Determinarea conținutului de metale grele s-a efectuat prin spectrofotometrie cu absorbție atomică, utilizând echipamentul Shimadzu GC-2100. În urma efectuării analizelor, au fost detectate în ambele sisteme de cultură (convențional și organic), atât în sol, cât și în legume un conținut de Cr, Ni, Cu, Zn, Cd și Pb. Conținutul de Cr, Ni, Cu și Zn din cadrul sistemului convențional a depășit limita maximă admisă de Regulamentul CE nr. 396/2005, în timp ce conținutul de metale grele din cadrul sistemului organic nu a depășit pentru niciun element chimic limitele maxime admise de Regulamentul CE nr. 396/2005.*

Cuvinte cheie: pătlăgele vinete, fertilizanți, producție, metale grele

INTRODUCTION

Organic farming involves the lifting of soil content in organic matter, using natural organic fertilizers (manure, compost, green fertilizers, slurry, urine + manure, etc.) and aims to achieve Agri-food products with a high content in biologically active substances, free of synthetic chemical substances which can seriously damage human health, in the circumstances of a durable, healthy and potentially high productivity ecosystem (Munteanu *et al.*, 2008; Stoleru *et al.*, 2014).

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In our country, the eggplant culture expanded after World War I, the current cultivation area being over 10.3 thousand hectares, with a total output of 144 thousand tonnes, in areas with the highest thermal Gradietul (Munteanu, 2003; Munteanu *et al.*, 2010; Popescu and Zăvoianu, 2013).

The overall objective is to highlight the cultivation that best lends itself to the cultivation conditions, but also to that which is not influenced by the concentration of chemical substances in the soil.

MATERIAL AND METHODS

The experience was carried out in a tunnel of 125 m² located in the vegetable field of the "V. Adamachi" Farm in Iasi.



Fig.1 The area of study UASVM Iasi

In order to achieve the proposed objectives, the best biological material of eggplant was used, which would perfectly adapt to the conditions within the field of experimentation. The choice of cultivation is one of the main principles for achieving production that satisfies human needs and is based on the adaptation of the variety to the region's climatic conditions (Indrea *et al.*, 2009; Munteanu, 2003; Munteanu *et al.*, 2011).

To achieve personal experience, four cultivars of Eggplants were worked, which adapted perfectly to climate and soil conditions within the culture environment, presenting a high resistance to the attack of pathogens. Thus, the varieties used were the following: Miraval F1, Aragon F1, Black Beauty and Raven Feather.

In order to obtain high harvests of each plant of *Solanum Melongena* L. Was given, in a single dose, the following quantity of fertilizer:

- 4 g Orgevit on the plant, together with appropriate irrigation (110,8 kg/ha);
- 2 g Nutrispore on the plant, together with appropriate irrigation (55,4 kg/ha);
- 5 g Micoseed per plant (138,5 kg/ha);
- 200 ml Veramin / 100 l water (6l/ha).

The working methods used to carry out research on cultivation under the conditions of a natural and organizational framework were the following: documentation (based on the principle of literature), the observation carried out in field, agrochemical analyses conducted in the laboratory, Case study and comparative

analysis (Stoleru *et al.*, 2015). Therefore, 10 samples were taken from the culture environment, from the base of 10 plants randomly located and analyzed in the laboratory.

The extraction and preparation of samples for the analysis carried out in the laboratory was carried out on the basis of compliance with the standards in force imposed by our country by the NSVFSA order – the National Health and Veterinary Authority and food safety No. 147/23/2005.

RESULTS AND DISCUSSION

The data presented in table 1. The fact that fruit develops much better in conventional system than the ecological system.

Table 1

Experimental results on some biometric characters of eggplant fruit (2016)

No.	Cultivars	Crop system	Fruit average (g)	Fruit height (cm)	No of fruits per plant
1.	Aragon F1	Intensiv	671	21	7-8
		Organic	617	20	7-8
2.	Black Beauty	Intensiv	519	23	6-7
		Organic	478	22	6-7
3.	Mirval F1	Intensiv	566	20	7-8
		Organic	521	18	7-8
4.	Pana Corbului	Intensiv	478	24	6-7
		Organic	440	20	6-7

With regard to the average weight of the fruit, results between 440 and 671 g/fruit were obtained. The fruits of the hybrid Aragon F1 were noted which in the conventional system had an average weight of 671 g and in the ecological system 617 g, far above the average of the control sample (Pana Corbului), the weight of which was 478 g in the conventional system and 440 g in organic system.

Early production obtained in the eggplant crop

The results of early production of eggplant aubergines are shown in table 2. It is considered to be early production, production achieved in protected spaces (tunnel) until fruit is opened in the open field.

Early production in the case of experimental variants was different from cultivar to cultivar, thus remarking the hybrid Aragon F1 with an average of 58.31 t/ha within the conventional system and 53.64 t/ha within the ecological system, obtaining a positively significant production of the witness sample, which was ranked in last place, totaling a quantity of 41.36 t/ha in conventional system and 38.05 t/ha in the ecological system.

Table 2

Early production of eggplant and the significance of differences to control (2016)

No.	Cultivars	Crop system	Early yield (t/ha)	Relative production (%)	Difference to the control (t/ha)	Significance of differences
1.	Aragon F1	Intensiv	58.31	140.98	16.95	***
		Organic	53.64	140.97	15.59	***
2.	Black Beauty	Intensiv	44.96	108.70	3.6	-
		Organic	41.36	108.69	3.31	-
3.	Mirval F1	Intensiv	50.06	121.03	8.7	**
		Organic	46.05	121.02	8	**
4.	Pana Corbului	Intensiv	41.36	100	0	-
		Organic	38.05	100	0	-

LSD 5% = 3.89 t/ha;

LSD 1% = 5.90 t/ha;

LSD 0.1% = 9.48 t/ha.

*** positively very significant; ** positively distinctly significant; - insignificant

The second hybrid in terms of production was Mirval F1, where an average of 50.06 t/ha was achieved in conventional system and 46.05 t/ha in the ecological system.

Total production obtained in the eggplant crop

The total production of eggplant obtained in the experience in both cultivation systems is shown in table 3.

Table 3

Total production of eggplant and the significance of differences to control (2016)

No.	Cultivars	Crop system	Total yield (t/ha)	Relative production (%)	Difference to the control (t/ha)	Significance of differences
1.	Aragon F1	Intensiv	139.34	140.251	39.99	***
		Organic	128.19	140.251	36.79	***
2.	Black Beauty	Intensiv	107.99	108.696	8.64	*
		Organic	99.35	108.698	7.95	-
3.	Mirval F1	Intensiv	117.77	118.540	18.42	**
		Organic	108.34	118.533	16.94	**
4.	Pana Corbului	Intensiv	99.35	100	0	-
		Organic	91.40	100	0	-

LSD 5% = 8.10 t/ha;

LSD 1% = 12.24 t/ha;

LSD 0.1% = 19.66 t/ha.

*** positively very significant; ** positively distinctly significant; - insignificant

Too, in the case of early production, the hybrid Aragon F1 was again remarked, with a production in the conventional system of 139.34 t/ha, compared to the witness sample, the raven variety, the production of which was 99.35 t/ha, the difference between the two cultivations being Approximately 40 t/ha. Within the ecological system, the difference compared to the witness sample of the hybrid Aragon F1 was 36.79 t/ha.

In the conventional system, the hybrid Mirval F1 obtained a production of 117.77 t/ha, and the Black Beauty variety production of 107.99 t/ha, the difference from the witness sample being 18.42 t/ha, respectively 8.64 t/ha. The production within the organic system of hybrid Mirval was 108.43 t/ha, and the Black Beauty variety of 99.35 t/ha, and the difference in production was 16.94 t/ha, respectively 7.95 t/ha.

Heavy metal content in eggplant fruits

In table 4, the content of contaminants in the eggplant fruit has been assessed and determined in accordance with the maximum permitted limits laid down by the legislation in force.

Table 4

The content of heavy metals in the fruits of eggplant (2016)

No.	Cultivars	Crop system	Cr (ppm)	Ni (ppm)	Cu (ppm)	Zn (ppm)	Cd (ppm)	Pb (ppm)
1.	Pana Corbului	Intensiv	71	43	58	153	<10	33
		Organic	46	27	28	112	<10	24
2.	Aragon F1	Intensiv	68	53	32	185	<10	43
		Organic	28	28	34	97	<10	15
3.	Mirval F1	Intensiv	58	40	48	150	<10	31
		Organic	32	30	40	78	<10	28
4.	Black Beauty	Intensiv	50	37	39	147	<10	22
		Organic	46	32	37	121	<10	18

As part of the experience, the minimum Cr content was determined by the hybrid Aragon F1 cultivated under the ecological system, while the maximum content was determined within the raven-feathered variety, cultivated under the conventional system.

In the cultivation there were no traces of Cd, the appliance recorded only concentrations greater than or equal to 10 ppm.

In general, in chemically fertilized variants the heavy metal content is higher than in organic variants.

CONCLUSIONS

Based on the results of the experience, the following were found:

The highest quantitative productions were obtained in the conventional system, regardless of the cultivation used.

The hybrid Aragon F1 was best suited, obtaining a production of 139.34 t/ha in conventional system, with approximately 40 tonnes over the production obtained under control.

Within the ecological system, the largest production of the 128.19 t/ha hybrid of Aragon F1, with 36.76 tonnes above the witness sample, proved that it was best suited to the ecological system.

The ecological culture system, although gaining lower productions compared to the conventional system, is an alternative because it causes healthy products to be obtained.

Generally, the content of heavy metals following way:
Zn>Cr>Cu>Ni>Pb>Cd.

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