AGRO-BIOLOGICAL STUDIES ON THE EGGPLANT CROPS UNDER PLASTIC TUNNEL IN ORGNIC FARMING

STUDII AGRO-BIOLOGICE PRIVIND CULTURA DE PĂTLĂGELE VINETE ÎN SOLAR ÎN SISTEM ECOLOGIC

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Abstract. *Solanum melongena L. are grown for their special nutritional intake in the body, such as carbohydrates, food salts, vitamins and polyphenols. Data from the scientific literature mention that the main method of establishing eggplant crops is through seedlings. Eggplants are a thermophilic species widely cultivated in different habitats, a low cultivation temperature (< 20 °C), as one of the major abiotic stresses, could significantly disturb the normal physiological and metabolic processes of eggplants. Eggplant crops play a main role in the world, with a high ecological plasticity, adaptable to different crop systems. Also, eggplant plants are affected by a large number of pathogens and pests, which is why solutions are sought using different methods of establishing the crops, under ecological farming. Thus, during the research, two eggplant cultivars (Mirval F_1 and Black Pearl F_1) were treated with organic and conventional fertilizers compared with control.*
Key words: cultivar, fertilizers, eggplant, yield indicators

Rezumat. *Pătlăgelele vinete sunt cultivate pentru aportul lor nutriţional, cum ar fi: carbohidraţii, sărurile minerale, vitaminele şi polifenolii. Datele din literatura ştiinţifică menţionează ca principală metodă de înfiinţare a culturilor de vinete, cultura prin răsaduri. Solanum melongena L. este o specie termofilă cultivată pe scară largă în diferite habitate, menţionându-se că temperatura scăzută din perioada de dezvoltare (<20 °C) este unul dintre stresurile abiotice majore, ce ar putea perturba semnificativ procesele fiziologice şi metabolice normale. Culturile de vinete joacă un rol principal în lume, cu o plasticitate ecologică ridicată, adaptabilă diferitelor sisteme de cultură. De asemenea, plantele de vinete sunt afectate de un număr mare de agenţi patogeni şi dăunători, motiv pentru care se caută soluţii folosind diferite metode de înfiinţare a culturilor, în cadrul sistemelor ecologice. Astfel, în timpul cercetării, au fost studiate două cultivare de vinete (Mirval F_1 şi Black Pearl F_1) fertilizate organic şi convenţional fiind comparate cu o variantă martor.*
Cuvinte cheie: cultivar, fertilizanţi, pătlăgele vinete, indicatori de producţie

INTRODUCTION

Eggplants (*Solanum melongena* L.) have grown widely in cultivation over the past four decades due to high consumer preferences, and also the fact that this species find favorable growing conditions, both in the field and protected areas, which ensure a good economic efficiency (Apahidean and Apahidean, 2001;

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Munteanu, 2003; Stan and Stan, 2010; Stoleru, 2013). All around the world as recorded in the literature (Petrov *et al*., 1980; Tseng *et al*., 2008; Passam *et al*., 2010; Osman and Rady, 2014; Sönmez *et al*., 2014; Takač *et al.,* 2015; Harsimran *et al.,* 2016; Nasiraei *et al.,* 2018), different technologies are practiced depending on the geographical area, pedoclimatic conditions, some traditions, involvement of technical and scientific research, ensuring an adequate material basis, the norms stated for the seeds legislation and the way they are respected and applied etc.

In order to ensure the sustainability of the production, the fertilization sequence must be accordingly to the requirements of the plants, depending on the desired production to be obtained but also depending on the quality of the fruits (Stoleru *et al.,* 2020). The specific consumption represents the amount of nutrients extracted from the soil necessary to obtain a tone of product. This differ from one species to another but also from a cultivar to another.

The longer the vegetation period is, the higher the amount of nutrients extracted from the soil is. At the same time, the consumption also differs depending on the phenophase. Vegetable species generally have high mineral requirements in the first grown phenophase which is due to less developed radicular system. As the plant grows, roots become stronger and they develop a higher absorption capacity (Munteanu, 2003).

In the past two decades many cultivars have been introduced in Romania, many of them without being tested beforehand which has led to a weak adaptation to different cultivation systems.

MATERIALS AND METHOD

Experimental site. The research was carried out during 2020 within the experimental stationary farm "V. Adamachi" from University of Agricultural Sciences and Veterinary Medicine Iasi, in a tunnel type according to the norms of organic agriculture (Stoleru *et al.,* 2014).

The experiment was organized in subdivided plots with three repetitions, 12 plants per experimental repetition (tab.1). The surface of an experimental plot was 3.56 m^2.

Biological material (Factor A) used was represented by the hybrid cultivars: a_1 = Mirval and a_2 = Black Pear.

Fig. 1 Mirval F_1

Fig. 2 Black Pearl F_1

Factor B – the fertilization of the crop with three graduations:

b_1 – chemical fertilization using Nutrispore with two formulas N:P:K, a complex fertilizer with N:P:K – 20:20:20, and 8:24:24, 400 kg/ha, applied on the soil when preparing the ground.

- Nutrispore, N:P:K – 20:20:20, was applied in the autumn when preparing the ground in a quantity of 400kg/ha.
- Nutrispore, N:P:K – 8:24:24, 200 kg/ha, applied in three phases – during vegetation period:

→ The 1-st application for N:P:K – 8:24:24 was performed 10 days after planting, when the seedlings have started their vegetation;

→ The 2-nd application was performed when the first fruit of the first inflorescence had a diameter of about 1cm;

→ The 3-rd application was performed when the first fruit reached maturity.

b_2 – biological fertilization with Micoseed MB of 60 kg/ha;

b_3 – control test.

Table 1

Experimental design

Cultivar – A	Fertilization method – B
A_1 – Mirval F_1	B_1 – Chemical fertilization using Nutrispore
	B_2 – Biological fertilization Micoseed MB
	B_3 – Control
A_2 – Black Pearl F_1	B_1 – Chemical fertilization using Nutrispore
	B_2 – Biological fertilization MB
	B_3 – Control

In order to achieve the established objectives were evaluated: the total number of fruits; the average number of fruits per plant; the average mass of a fruit; the total production; the diameter and the height of the fruit.

Statistical Analysis

The results were reported as means ± standard errors. The ANOVA test was used to highlight the statistical significance among genotype characteristics and crop system differences. Where the differences were significant, Tukey's test ($p \leq 0.05$) multiple comparison tests was used. The software used was SPSS v21 (IBM Corp, Armonk, NY, USA).

Statistical analyses for experimental factors are presented in the table 2.

Table 2

Analysis of variance for studied factors

Total fruits					
Specification	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	12,139.78	5	2,427.96	7.59	0.001
Within Groups	3,865.33	12	322.11		
Total	16,005.11	17			
Average fruits per plant					
Specification	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7,126.00	5	1,425.00	6.53	0.004
Within Groups	2,620.00	12	2,180.00		
Total	9,746.00	17			

Fruit diameter					
Specification	Sum of squares	df	Mean square	F	Sig.
Between Groups	172.16	5	34.43	1.52	0.253
Within Groups	270.58	12	22.54		
Total	442.74	17			
Fruit higher					
Specification	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	99.43	5	1.88	8.92	0.001
Within Groups	26.74	12	2.22		
Total	126.17	17			
Weight fruits					
Specification	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	4,163.77	5	832.75	2.51	0.089
Within Groups	3,979.33	12	33.61		
Total	8,143.11	17			
Yield					
Specification	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1,111.19	5	222.23	3.89	0.025
Within Groups	685.18	12	57.09		
Total	1,796.37	17			

RESULTS AND DISCUSSIONS

The highest number of fruits was made in biological fertilized variants for both varieties, respectively 324 and 325 fruits and the lowest number of fruits was at witness test (tab. 3). Normally, the number of fruits is a genetic constant, but from biological point of view the cultivars reacts differently in different technological measure, especially to *Solanaceae* (Caruso *et al.* 2019).

The highest average number of fruits per plant was achieved in the biological variants, the difference from the witness test being significant. This difference is being exemplified by analysis tables of variance (tab. 3).

Table 3

Number of harvested fruits per variants

No. crt.	Experimental factors	No of harvested fruits per variant	No of fruits per plant
1	Mirval F_1 x Control	249.67±13.87c	7.80±0.43c
2	Mirval F_1 x Biological	325.33±3.18a	9.38±0.16a
3	Mirval F_1 x Chemical	302.67±9.26ab	8.81±0.27ab
4	Black Pearl F_1 x Control	288.00±7.23b	8.00±0.73bc
5	Black Pearl F_1 x Biological	324.33±11.84a	9.44±0.26a
6	Black Pearl F_1 x Chemical	311.34±12.78ab	8.89±0.27a

From a statistical point of view, the fruits diameter between the experimental variants is non-significant. The fruits height can be observed to be a

variety constant (genetic determination) and not determined by the type of fertilization (tab. 4).

The new varieties of eggplants (Mirval and Black Pearl) are adapting very well to the ecological culture system where can be obtained great results.

Table 4

Biometrical indicators of fruits

No. crt.	Experimental factors	Fruits Diameter (mm)	Fruits Height (cm)	Shape index
1	Mirval F_1 x Control	84.13±4.83ns	25.56±0.28a	3.04
2	Mirval F_1 x Biological	89.00±0.72 ns	26.58±1.39a	2.99
3	Mirval F_1 x Chemical	86.50±0.91 ns	27.50±1.04a	2.85
4	Black Pearl F_1 x Control	91.63±1.94 ns	22.43±0.69b	2.45
5	Black Pearl F_1 x Biological	91.50±0.80 ns	22.10±0.06b	2.42
6	Black Pearl F_1 x Chemical	92.83±3.99 ns	21.52±0.93b	2.32

In table 5 is presented the average weight of the fruits from which can be noticed that the hybrid Mirval achieves the highest fruit weight due o biological fertilization and Black Pearl due to control.

The highest total production was obtained from both varieties in the biological variant, the differences compared to the Control test being significant (tab. 5).

The insignificant results compared to the biological variant were obtained in the chemical variant.

Table 5

Results regarding the yield of eggplants

No. crt.	Experimental factors	Average fruits weight	Total production (t/ha)
1	Mirval F_1 x Control	397.00±5.29b	88.45±6.05b
2	Mirval F_1 x Biological	420.00±12.74ab	112.28±3.06a
3	Mirval F_1 x Chemical	410.34±16.73b	103.22±6.45a
4	Black Pearl F_1 x Control	446.00±10.40a	101.74±3.30ab
5	Black Pearl F_1 x Biological	414.00±3.05ab	111.46±2.83a
6	Black Pearl F_1 x Chemical	407.33±8.67b	103.12±2.74a

CONCLUSIONS

1. The hybrid Mirval adapted very well, obtaining significant results in terms of height, diameter and fruit weight.
2. Regarding the biological fertilization significant values were recorded;

3. The interaction between the variety and the type of fertilization, respectively hybrid Mirval and biological fertilization have recorded significant values.

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