

The Influence of Substrate and Fertilization Method on Eggplants Cultivated in Polyethylene Greenhouse

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Abstract. In the experiment carried out in a greenhouse in 2010 at University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania, the influence of substrate and fertilization method on yield of eggplants was investigated. For the plants cultivated on reused organic substrate the yield difference was significant negative for both early and total yield comparative with variants with plants cultivated on new organic substrate. The fertilization method influenced only the early yield. Thus, the organically fertilized plants registered yield differences distinct significant negative in comparison with chemical fertilized ones. In the case of total yield, no significant differences between two methods of fertilization were recorded. Combination of factors has influenced both early and total yield, best results were obtained for variants cultivated on new organic substrate, indifferent to the fertilization method.

Keywords: eggplant, polyethylene greenhouse, cultivation substrate, fertilization

INTRODUCTION

According to literature data, eggplants can be cultivated with good results on mineral substrates-perlite or sand (Hamdy *et al.*, 2004), as well as on polyurethane slabs (Benoit *et al.*, 1990). Iapichino *et al.* (2007) studied possibility of eggplants cultivation in polystyrene slabs, while Pinker and Böhme (2009) elaborated greenhouse cultivation of eggplants in perlite, peat and with NFT systems. Gajewski (2009) reported the influence of growing medium (coconut fiber, wood fiber and rockwool) on sensory quality and physical traits of eggplant fruit. Michalójc and Buczkowska (2008) showed the influence of different nitrogen fertilizers on eggplants yield, when cultivation in peat substrate was applied. Politycka and Golcz (2006) studied the possibility of peat and peat plus bark substrates reuse in eggplants cultivation during 3 years. They reported that reuse of peat resulted in a decrease of yield while the reuse of peat plus bark substrate had positive effect on the yield.

The objective of this study was to evaluate the possibility of eggplants cultivation in containers filled with limited volume of different substrates. The method was not investigated yet in the case of Romanian climatic conditions. The possibility of applying only organic fertilizers in order to reduce cultivation costs and to decrease the risk of nitrates accumulation in the fruits over the accepted limit, was also studied.

MATERIALS AND METHODS

In the experiment was used the eggplant hybrid Mirval F₁, produced by the French seed company Vilmorin.

This is a very early hybrid, productive, with black, bright, big fruits, about 400-450 g. Plants are vigorous, resistant to high temperatures, with short internodes and aerated foliage.

In order to establish some technological sequences for eggplant culture in greenhouses it was organized in 2010 at University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania, a bifactorial experiment with the following:

Factor A: culture substrate with two graduations: a₁- new substrate;
a₂-reused substrate

Factor B: foliar fertilization method with two graduations: b₁-chemical fertilizer;
b₂-organic fertilizer.

By factor combination have resulted 4 experimental variants presented in table 1.

Tab. 1

Experimental variants

Variant	Substrate of culture	Fertilization method
I a ₁ b ₁	New substrate	Chemical fertilization
II a ₁ b ₂	New substrate	Organic fertilization
III a ₂ b ₁	Reused substrate	Chemical fertilization
IV a ₂ b ₂	Reused substrate	Organic fertilization

Each experimental graduation had 3 replicates, the surface of experimental plot being about 7.5 m².

The experiment started on 14th of April 2010, with seedlings produced in pots with 10 cm diameter. Plants of I and II variants were cultivated on new Klasmann peat substrate (T.S.3) and plants of III and IV variants were cultivated on the same type of substrate but that had been used for eggplant culture in the previous year. Each plant was grown in 10 L volume of substrate.

Foliage fertilizations were done once at two weeks for all experimental variants. Plants of I and III variants were chemically fertilized with Complex III fertilizer (N:P:K 16:16:16), applied as 1% concentrated solution and plants of II and IV variants were fertilized with manure in water dilution 1:10.

Plants from all experimental variants were directed with two braches.

At each harvesting, yield was determined by weighting for each variant and replicate, being after calculated for 1 m².

RESULTS AND DISCUSSION

Early yield

Analyzing the influence of substrate on early yield of eggplants (Tab. 2) it can be noticed that yield of plants cultivated on reused substrate registered a yield difference about 0.61 kg/m², significant negative comparative to variants cultivated on new substrate.

Tab. 2

Unilateral influence of substrate on greenhouse eggplant early yield (at 31st of July)

Variant	Early yield (kg/m ²)	%	Difference ±	Significance of difference
Culture on new substrate	2.76	100.0	-	-
Culture on reused substrate	2.15	77.9	-0.61	o
LSD 5%			0.27	
LSD 1%			0.62	
LSD 0.1%			1.99	

Regarding the unilateral influence of fertilization method on early yield (Tab. 3), it can be observed a significant decrease of the yield in the case of organically fertilized plants (of 0.43 kg/m²), distinct significant negative in comparison with mineral fertilized plants.

Tab. 3

Unilateral influence of fertilization method on greenhouse eggplant early yield (at 31st of July)

Variant	Early yield (kg/m ²)	%	Difference ±	Significance of difference
Chemical fertilization	2.67	100.0	-	-
Organic fertilization	2.24	84.0	-0.43	oo
LSD 5%			0.23	
LSD 1%			0.39	
LSD 0.1%			0.72	

Analyzing the combined influence of experimental factors on early yield of eggplants cultivated in greenhouse (Tab. 4) it can be observed that yields of all variants were lower than the yield of control variant (new substrate culture, chemical fertilization). Yield differences of variants III and IV, cultivated on reused substrate, both in case of chemical and organic fertilization are negative distinct significant comparative with the control.

Tab. 4

Combined influence of both factors on greenhouse eggplant early yield (at 31st of July)

Substrate of culture	Fertilization	Early yield (kg/m ²)	%	Difference ±	Significance of difference
New	Chemical fertilization	3.08	100.0	-	-
New	Organic fertilization	2.44	79.2	-0.64	o
Reused	Chemical fertilization	2.26	73.4	-0.82	oo
Reused	Organic fertilization	2.04	66.2	-1.04	oo
LSD 5%				0.35	
LSD 1%				0.68	
LSD 0.1%				1.77	

Relatively production (79.2%) of variant II (culture on new substrate and organic fertilization) is significant negative comparative to control.

Total yield

The results obtained for total yield are a little bit different to those obtained for early yield.

Analyzing the unilateral influence of substrate on total yield (Tab. 5) of greenhouse eggplants it can be observed that similar with early yield variants cultivated on reused organic substratum registered an yield difference about 0.72 kg/m², significant negative comparative to variants cultivated on new organic substratum.

Tab. 5

Unilateral influence of substrate on greenhouse eggplant total yield

Variant	Early yield (kg/m ²)	%	Difference ±	Significance of difference
Culture on new substrate	6.07	100.0	-	-
Culture on reused substrate	5.35	88.1	-0.72	o
LSD 5%			0.58	
LSD 1%			1.33	
LSD 0.1%			4.24	

Concerning the unilateral influence of fertilization method on total yield (Tab. 6) it can be noticed, unlike the early yield, a slight increase of 0.7%, statistically uninsured, for the variants organically fertilized comparative to those chemically fertilized.

Tab. 6

Unilateral influence of fertilization method on greenhouse eggplant total yield

Variant	Early yield (kg/m ²)	%	Difference ±	Significance of difference
Chemical fertilization	5.69	100.0	-	-
Organic fertilization	5.74	100.7	+0.04	-
LSD 5%			0.38	
LSD 1%			0.63	
LSD 0.1%			1.18	

Analyzing the interaction of experimental factors on total yield of eggplants (Tab. 7), it can be seen that plants from variants II (cultivated on new substrate and organically fertilized) realized a yield increase about 2.8% comparative to control (culture on new substrate and chemical fertilization) but statistically uninsured.

Tab. 7

Combined influence of both factors on greenhouse eggplant total yield

Substrate of culture	Fertilization	Early yield (kg/m ²)	%	Difference ±	Significance of difference
New	Chemical fertilization	5.99	100.0	-	-
New	Organic fertilization	6.16	102.8	+0.17	-
Reused	Chemical fertilization	5.40	90.2	-0.59	-
Reused	Organic fertilization	5.31	88.6	-0.68	o
LSD 5%				0.68	
LSD 1%				1.38	
LSD 0.1%				3.81	

Plants from variant III (culture on reused substrate and with chemical fertilization) registered a yield difference about 0.59 kg/m² comparative to control but also statistically uninsured.

Only plants from variant IV (culture on reused substrate and organic fertilization) registered a relative yield about 88.6% comparative to control, significant negative.

CONCLUSIONS

From experiences performed in 2010 on greenhouse eggplants culture the following main conclusions can be drawn:

Both early and total yield were influenced very much by substrate of culture. Plants from variants cultivated on reused organic substrate registered relative yields about 77.9% for early yield respectively 88.1% for total yield comparative to plants cultivated on new organic substrate. These results are due to degradation to some extend of hydro-physical characteristics of old substrate, which led to a poor absorption of water and minerals.

Fertilization method influenced especially early yield. Thus, plants from variants with organic fertilization registered for early yield negative distinct significant differences comparative to control. Fertilization method had no significant influence on total yield. These results are due to a more equilibrated mineral nutrition, especially in the first period of vegetation, in the case of chemical fertilization comparative to organic fertilization. In the second part of vegetation period mineral nutrition equilibrates due to mineralization of organic matter.

Analyzing the combine influence of both factors, the best results are obtained by variant I (culture on new substrate and chemical fertilization) for early yield respectively by variant II (culture on new substrate and organic fertilization) for total yield.

REFERENCES

1. Benoit, F. and N. Ceustermans (1990). Soilless culture of eggplant (*Solanum melongena* L.) on recycled polyurethane ether foam (PUR). (Proceedings of the 11th international congress on the use of plastics in agriculture, New Delhi, India, 26th February-2nd March 1990.
2. Gajewski, M., K. Kowalczyk, M. Bajer and J. Radzanowska (2009). Quality of eggplant fruits in relation to growing medium used in greenhouse cultivation and to a cultivar. *Notulae Botanicae Horti Agrobotanici Cluj-Napoca* 37(1):229-234.
3. Hamdy, A., W. Chouaib and G. Pacucci (2004). Eggplant production in soilless culture under saline irrigation practices and soil conditioner application. *Acta Hort. (ISHS)* 633:245-251.
4. Iapichino, G., A. Moncada and F. D'Anna (2007). Planting density and pruning method affect eggplant soilless culture. *Acta Hort. (ISHS)* 747:341-346.
5. Michalój, Z. and H. Buczkowska (2008). Content of macroelements in eggplant fruits depending on nitrogen fertilization and plant training method. *J. Elementol.* 13(2):269-274.
6. Pinker, I. and M. H. Böhme (2009). Cultivation of different eggplant (*Solanum melongena* L.) in substrate culture and NFT-system: *Acta Hort. (ISHS)*: 819, S. 345-352
7. Politycka, B. and A. Golcz (2006). Soil sickness syndrome in organic substrates repeatedly used in eggplant (*Solanum melongena* L.) culture. *Allelopathy Journal* 18(1):39-46.