

# The Influence of Cultivation and Fertilization Methods on Yield of Eggplants Grown in a Polyethylene Greenhouse

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## Abstract

In the experiment carried out in 2009 at University of Agricultural Sciences and Veterinary Medicine, Cluj-Napoca, Romania, the influence of cultivation and fertilization methods on yield of eggplants grown in polyethylene greenhouse was investigated. In the experiment, the early and total yields, as well as yield quality were determined. For the plants cultivated in organic substrate the yield reached about 92.9% in the case of early yield and about 58.6% in the case of total yield in comparison with the plants cultivated in soil. The fertilization method influenced to a small extent the yield, however in the case of the early yield the organically fertilized plants showed decrease of the yield in comparison with chemical fertilized ones. In the case of total yield, no significant differences between objects fertilized with chemical and organic fertilizers were recorded. Both in the case of early yield and total yield, the best results were obtained for plants cultivated on organic substrate, irrespective the fertilization method.

**Keywords:** eggplant, polyethylene greenhouse, cultivation method, 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. Michalojć 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

The eggplant hybrid 'Madonna' F<sub>1</sub> obtained from Dutch seed company De Ruiters Seeds, was used in the experiment. This hybrid is recommended for greenhouse

cultivation. The plants are characterized with big vigor, have well developed root system, black colored fruit with few seeds and white fruit pulp. Medium weight of fruit is about 350-400 g.

The bifactorial experiment was carried out in 2009 in polyethylene greenhouses at University of Agricultural Sciences and Veterinary Medicine Cluj-Napoca, Romania.

Factor A: cultivation method; a<sub>1</sub>-soil culture; a<sub>2</sub>-culture on organic substrate in polyethylene bags.

Factor B: fertilization method; b<sub>1</sub>-chemical fertilizer; b<sub>2</sub>-organic fertilizer.

The four experimental objects are presented in Tab. 1.

Each experimental object had 4 replicates, the surface of experimental plot being about 9 m<sup>2</sup>.

The experiment started on 14 of April, with seedlings produced in pots with 10 cm diameter, filled with nutritive substrate. Plants of III and IV objects were cultivated on Klasmann peat substrate (T.S.3), to each plant its due being about 8 L of substrate.

Fertilizations were done once at two weeks for all experimental objects. Plants of I and III objects 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 (N:P:K 2,5:1,2:4)

Tab. 1. Experimental objects

Objects	Cultivation method	Fertilization method
I a <sub>1</sub> b <sub>1</sub>	in soil	Chemical
II a <sub>1</sub> b <sub>2</sub>	in soil	Organic
III a <sub>2</sub> b <sub>1</sub>	in organic substrate	Chemical
IV a <sub>2</sub> b <sub>2</sub>	in organic substrate	Organic

diluted with water 1:10. At each harvesting, yield was determined by weighting for each object and replicate, being after calculated for 1 m<sup>2</sup>.

## Results and discussion

### Early yield

Analyzing the influence of growing method on early yield of eggplants (Tab. 2) it can be noticed that yield of plants cultivated in peat substrate showed reached about 92.9% in comparison with yield of plants cultivated in soil.

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 0.44 kg/m<sup>2</sup>), in comparison with minerally

Tab. 2. Unilateral influence of cultivation methods on early yield (till 31 of July) of eggplants (Cluj-Napoca, 2009)

Objects	Early yield kg/m <sup>2</sup>	%	Difference ±	Significance of difference
Cultivation in soil	1.70	100.0	-	-
Cultivation on organic substrate	3.28	192.9	+1.58	**
LSD 5%			0.65	
LSD 1%			1.19	
LSD 0.1%			2.63	

fertilized plants.

Analyzing the combined influence of experimental factors on early yield of eggplants (Tab. 4) it can be observed that the best results were obtained from object III (organic substrate culture, chemical fertilization), with a significantly higher yield, reached about 113.3% in comparison with the control (variant I, soil culture, chemical fertilization).

Object IV (organic substrate culture, organic fertilization) showed a positive influence on yield in comparison with the control. It was not recorded any significant difference between the yield of plants from the object II (soil culture, organic fertilization) and the control plants.

Tab. 3. Unilateral influence of fertilization method on early yield (until 31 of July) of eggplants (Cluj-Napoca, 2009)

Objects	Early yield kg/m <sup>2</sup>	%	Difference ±	Significance of difference
Chemical fertilization	2.71	100.0	-	-
Organic fertilization	2.27	83.9	-0.44	0
LSD 5%			0.36	
LSD 1%			0.55	
LSD 0.1%			0.89	

Tab. 4. Combined influence of experimental factors on early yield (until 31 of July) of eggplants (Cluj-Napoca, 2009)

Objects	Early yield	%	Difference ±	Significance of difference
I	1.73	100.0	-	-
II	1.67	96.5	-0.06	-
III	3.69	213.3	+1.96	**
IV	2.88	166.5	+1.15	*
LSD 5%			0.74	
LSD 1%			1.28	
LSD 0.1%			2.64	

### Total yield

The results obtained in the case of total yield confirm those obtained in the case of early yield. Analyzing the unilateral influence of cultivation method on total yield of eggplants (Tab. 5), it can be observed that plants cultivated in organic substrate, in polyethylene bags, showed significant increase of yield, about 58.6% in comparison with plants cultivated in soil.

It can be seen a little tendency to decrease of yield in the case of organic fertilization in comparison with chemical fertilization (Tab. 6).

Analyzing the interaction of experimental factors on total yield of eggplants (Tab. 7), it can be seen that plants from objects III (organic substrate culture, chemical fertilization) and IV (organic substrate culture, organic fertilization) gave the highest yield in comparison with control (soil culture, chemical fertilization).

### Marketable quality yield

Tab. 5. Unilateral influence of system of culture on total yield of eggplants (Cluj-Napoca, 2009)

Objects	Total yield kg/m <sup>2</sup>	%	Difference ±	Significance of difference
Culture in soil	4.53	100.0	-	-
Culture on organic substrate placed in polyethylene bags	7.19	158.6	+2.66	**
LSD 5%			0.68	
LSD 1%			1.24	
LSD 0.1%			2.75	

Tab. 6. Unilateral influence of fertilization method on total yield of eggplants (Cluj-Napoca, 2009)

Objects	Total yield kg/m <sup>2</sup>	%	Difference ±	Significance of difference
Chemical fertilization	6.19	100.0	-	-
Organic fertilization	5.53	89.3	-0.66	-
LSD 5%			0.69	
LSD 1%			1.05	
LSD 0.1%			1.69	

Tab. 7. Combined influence of experimental factors on total yield of eggplants (Cluj-Napoca, 2009)

Objects	Total yield kg/m <sup>2</sup>	%	Difference ±	Significance of difference
I	4.63	100.0	-	-
II	4.44	95.9	-0.19	-
III	7.76	167.6	+3.13	***
IV	6.63	143.2	+2.00	**
LSD 5%			0.96	
LSD1 %			1.59	
LSD 0.1%			3.00	

Analyzing marketable quality yield (Tab. 8), it can be seen that the share of I<sup>st</sup> fruit quality from the total yield was between 73.2% and 82.9%, without major differences among experimental objects. Object III (organic substrate culture, chemical fertilization) had most of the fruits of the I<sup>st</sup> quality, respectively 6.43 kg/m<sup>2</sup>. The highest yield of I<sup>st</sup> quality fruit was found for objects III and IV (185.8% and 154.0%, respectively, comparing with the control).

Tab. 8. Marketable quality fruits of eggplants (Cluj-Napoca, 2009)

Objects	Yield (kg/m <sup>2</sup> )			Percentage of I <sup>st</sup> quality fruits	
	Total	I <sup>st</sup> quality	II <sup>nd</sup> quality	From total	Given the control
I	4.63	3.46	1.17	74.7	100.0
II	4.44	3.25	1.19	73.2	93.9
III	7.76	6.43	1.33	82.9	185.8
IV	6.63	5.33	1.30	80.4	154.0

## Conclusions

On the basis of the experiment it can be concluded that both early and total yield were influenced especially by cultivation method. Yield of plants cultivated in polyethylene bags in organic substrate reached about 92.9% in case of early yield and about 58.6% in case of total yield in comparison with plants cultivated in soil.

Fertilization method influenced especially early yield and to a smaller extent total yield. Plants fertilized with organic fertilizer showed lower early yield in comparison with minerally fertilized plants. Fertilization method had no significant influence on total yield. The highest early and total yield were obtained in the case of plants grown in organic substrate and fertilized with chemical fertilizer, as well as in the case of plants grown in organic substrate and fertilized with organic fertilizer.

## References

- Benoit, F. and N. Ceustermans (1990). Soilless culture of eggplant (*Solanum melongena* L.) on recycled polyurethane ether foam (PUR). (Proceedings of the 11<sup>th</sup> international congress on the use of plastics in agriculture, New Delhi, India, 26<sup>th</sup> February-2<sup>nd</sup> March 1990.
- 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.
- 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.
- Iapichino, G., A. Moncada and F. D'Anna (2007). Planting density and pruning method affect eggplant soilless culture. *Acta Hort.* (ISHS) 747:341-346.
- Michalój, Z. and H. Buczkowska (2008). Content of macrolelements in eggplant fruits depending on nitrogen fertilization and plant training method. *J. Elementol.* 13(2):269-274.
- Pinker, I. and M. H. Böhme (2009). Cultivation of different eggplant (*Solanum melongena* 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.
- 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.