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BARTOSZ MARKIEWICZ[1], ANNA GOLCZ[1], BARBARA POLITYCKA[2]

EFFECT OF SUBSTRATE UTILIZATION TIME ON THE YIELD OF EGGPLANT (*SOLANUM MELONGENA* L.)

From [1]Department of Horticultural Plants Nutrition
and from [2]Department of Plant Physiology
August Cieszkowski Agricultural University of Poznań

ABSTRACT. Eggplant 'Solara F_1' cultivar was grown in two organic substrate types: raised peat and pine bark with low-moor (v:v = 1:1), used in year I and year II. It was found that the yield of eggplant re-used substrate was lower. It is supposed that it was the result of an accumulation of post-harvest residues and excessive concentration of salt.

Key words: eggplant, yield, organic substrate, re-used substrate

Introduction

The cultivation of eggplant in Poland because of its high thermal requirements is not very popular, so far. However, sitiologists and consumers show an increasing interest in this species because eggplant fruits are valued due to their taste and dietetic properties (**Cebula** and **Ambroszczyk** 1999). High costs of plant growing under cover force to look for more economic solutions of the cultivation. One of them is the possibility of re-utilization of the same substrate. Because of a limited possibility of species rotation, there exists a risk of the appearance of substrate fatigue (**Pudelski** et **al.** 1982, **Polity-cka** and **Wójcik-Wojtkowiak** 1988), although this is not an absolute rule (**Golcz** and **Politycka** 2001). The objective of this work was the verification of the possibility of the utilization of organic substrates in eggplant growing.

Material and methods

Vegetation experiment in eggplant growing in an unheated foil tunnel was carried out May to September 2003 in the Experimental Station „Marcelin", The August Ciesz-

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kowski Agricultural University of Poznań. A Dutch cultivar 'Solara F_1' (Seminis Vegetable Seeds) was used in the studies.

The plants were grown in rings of 6 dm^3 volume in two types of substrate: raised peat and mixture of pine bark and low-moor (v:v – 1:1). The experiment employed fresh substrates (used for the first time – year I) and substrates used for the second time which after the termination of the growing period in 2002 were stored until the next vegetation season in 2003.

Before the start and after the termination of the growing season, phytotoxicity of the substrates was determined. The criterion of phytotoxic compounds occurrence was the growth inhibition of cucumber seedling roots in a biological assay (**Pudelski** et **al.** 1982). Substrate extracts were prepared according to the method described by **Politycka** et **al.** (1989).

During vegetation, top dressing was applied to supplement the component content to the assumed standard level keeping the proportions of N:P:K = 1:0.9:1.7 on the basis of substrate analysis carried out by the universal method of **Nowosielski** (1988). Furthermore, in one month intervals, measurements of salt concentration in the substrates were carried out by conductometric method.

The plants were managed with two leading shoots. Cultivation treatments and plant protection against pests was carried out according to the recommendations for this species.

Fruits were harvested several times in the phase of physiological maturity and marketable yield, number of fruits and the mean mass of a single fruit were defined.

Results and discussion

Before the cultivation of eggplant in both types of substrates used in the experiment, no substance of phytotoxic character was found (Table 1). In the substrate consisting of pine bark and low-moor peat, there occurred a stimulation effect in the root growth of the test plant (cucumber). However, an inhibiting action of the extracts from both substrates was observed after the termination of eggplant growing. It was stronger in case of the mixed substrate (pine bark with low-moor peat) as compared with the raised peat substrate. The presence of phytotoxic compounds in the cultivation of the same species was observed earlier by **Wójcik-Wojtkowiak** (1980), **Pudelski** et **al.** (1982), **Politycka** and **Wójcik-Wojtkowiak** (1988).

In substrates used the second time, a high concentration of salt was found and it kept increasing throughout the growing time (max. 4.76 g NaCl · dm^{-3}) (Fig. 1). The admissible salt concentration in substrates for the plants of *Solanaceae* family is up to 3.0 g NaCl · dm^{-3} (**Komosa** 2003). This phenomenon causes an unbalance between the components of the soil solution leading to synergism or ion antagonism. The negative effect of salination can be the result of toxical of a single ion on the plant, or it can be caused by the exceeding of the plant tolerance to the total salt concentration leading to a limited water uptake by the plant (**Breś** et **al.** 2003).

The application of a re-used substrate to the cultivation of eggplant, independent of the substrate type, caused a significant drop in the yield on the average by 56% and a decreased number of fruits (by 53%) (Table 2) as well it had a negative effect on the mean

mass of fruits. The mean mass of fruits from low-moor peat substrate decreased by 12%, while the mean mass of fruits from pine bark mixed with low-moor decreased by 24%.

Table 1

Analysis of substrates on the content of phytotoxic compounds
Analiza podłoży ze względu na zawartość substancji fitotoksycznych

Substrate Podłoże	Years of substrate use Rok użytkowania podłoża	Before cultivation Przed uprawą		After cultivation Po zakończeniu uprawy	
		root length długość korzeni (mm)	percentage of control procent kontroli	root length długość korzeni (mm)	percentage of control procent kontroli
Raised peat Torf wysoki	bioassay control kontrola biotestu	17.50	100. 00	21.20	100.00
	I II	17.25 16.80	98.57 96.00	17.70 18.0	83.49 88.67
Pine bark + low-moor peat Kora sosnowa + torf niski	I II	21.25 20.60	121.42 117.71	17.00 15.00	80.18 70.75

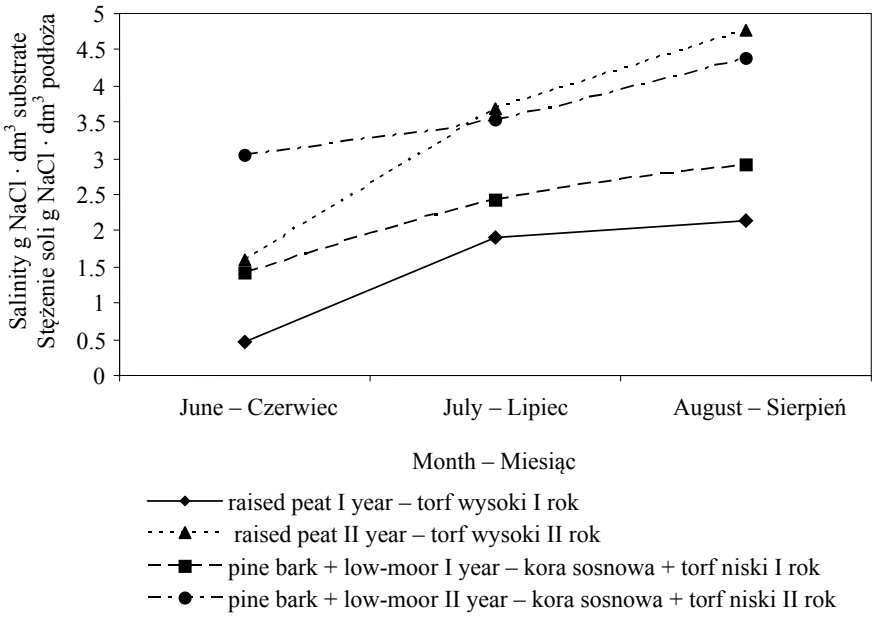

Fig. 1. Substrate salinity in the course of eggplant cultivation
Ryc. 1. Stopień zasolenia podłoży podczas uprawy oberżyny

Table 2

Effect of substrate type and time of its use on yielding of eggplant
Wpływ rodzaju podłoża i czasu jego użytkowania na plonowanie oberżyny

Substrate Podłoże	Fresh substrate (I year) Podłoża użytkowane I rok			Re-used substrate (II year) Podłoża użytkowane II rok		
	marketable yield plon handlowy kg · m^{-2}	number of fruits pcs · m^{-2} liczba owoców szt. · m^{-2}	mean mass of fruit średnia masa owocu g	marketable yield plon handlowy kg · m^{-2}	number of fruits pcs · m^{-2} liczba owoców szt. · m^{-2}	mean mass of fruit średnia masa owocu g
Raised peat Torf wysoki	13.19	35.0	376.8	5.98	18.0	332.2
Pine bark + low-moor peat Kora sosnowa + torf niski	8.59	23.3	368.6	3.72	13.4	277.6
Mean values Średnia dla podłoży	10.89	29.15	372.7	4.85	15.7	304.9

The observed yield decrease obtained on re-used organic substrates confirms the results of other authors (**Politycka** and **Wójcik-Wojtkowiak** 1988, **Politycka** et **al.** 1989). The post-harvest residues in the substrate are subjected to slow decomposition releasing phytotoxic substances. The time between cultivations does not permit a complete decomposition of the residues in the substrate, so the remaining root mass and its decomposition products can exert a negative effect on the plant yielding in the successive cultivation period (**Wójcik-Wojtkowiak** 1980).

It can be supposed that excessive concentration of salt in the substrate could increase the unfavourable effect exerted by the harvest residues on the eggplant yield.

Conclusions

1. During the growing of eggplant in organic substrates, there followed an accumulation of a substance of phytotoxic character as well as an excessive salt concentration.
2. The application of re-used organic substrates resulted in a significant decrease of eggplant yield.

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WPŁYW CZASU UŻYTKOWANIA PODŁOŻA NA PLON OBERŻYNY (*SOLANUM MELONGENA* L.)

S t r e s z c z e n i e

W nieogrzewanym tunelu foliowym przeprowadzono od V do IX 2003 roku doświadczenie z uprawą oberżyny odm. 'Solara F_1'. Rośliny uprawiano w pierścieniach o objętości 6 dm^3 w dwóch podłożach: w torfie wysokim oraz w mieszaninie kory sosnowej i torfu niskiego (v:v – 1:1). W uprawie zastosowano podłoża świeże (użytkowane pierwszy rok) oraz podłoża powtórnie użytkowane. Podczas wegetacji roślin w podłożach następowała akumulacja substancji o charakterze fitotoksycznym oraz nadmierny wzrost stężenia soli. Powtórne użytkowanie badanych podłoży organicznych spowodowało znaczne obniżenie plonu owoców oberżyny.