Scientific Papers, Series B, Horticulture, Vol. LVI, 2012
ISSN Online 2286-1580, ISSN-L 2285-5653

COMPARISON OF TRICHODERMA SP. USE EFFICIENCY ON CUCUMBERS AND LETTUCE

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Abstract

The effect of additional soil microorganisms' preparations (Trichoderma viride, Trichoderma lignorum) on cucumber cv. 'Pioneer' and lettuce cv. 'Grand Rapids' growth and quality as well as peat substratum biological activity was studied. Trichoderma sp. added as liquid culture in concentration 20 and 100 mL m^{-2}. Substratum was treated 3 days before plants were potted. Plant growth parameters and yield was analyzed. Soil respiration intensity was measured by changes of carbon dioxide, soil enzymatic activity assessed by dehydrogenase and fluorescein diacetate (FDA) hydrolysis activity. Trichoderma viride stimulated plant vegetative growth. Both preparations increased plant fresh weight in comparison with control. The increased level of chlorophylls was observed in cucumber leaves as effect of Trichoderma lignorum. Plant species had different sensitivity to additional microorganisms. Effect of preparation depended on plant development stage. Microorganisms' preparations differently affect soil enzymes activity. Peat substratum without plants showed decreased soil respiration intensity, but increased dehydrogenases activity.

Key words**:** *Trichoderma viride, Trichoderma lignorum, cucumber, lettuce, enzymes*

INTRODUCTION

Free-living fungi *Trichoderma* spp. are highly interactive in root, soil and foliar environments. Beneficial microorganisms enhance plant growth through numerous mechanisms and can also compete with other microorganisms for nutrients and/or space [4]. Experiments carried out in different locations have demonstrated that under certain environmental and soil and growing media conditions inoculation with microorganisms has beneficial effects on plant yield. It is reported that *Trichoderma spp.* promoted growth and development of seedlings of vegetable, namely cabbage, cucumber, tomatoes and lettuce [2, 8, 10, 4]. Cucumber, bell pepper and strawberry yields were increased significantly following the application of *Trichoderma spp.* [1, 3, 12]. Many species of *Trichoderma* can enhance growth, development and yield on different plants: *T. harzianum* and *T. viride* in cucumber and bell peppers [8, 3], *T. longipile, T. tomentosum* and *T. virens* in cabbage [11]. Some of the *Trichoderma* species may interact better with certain plant species. In other words so called "affinity" of some of the *Trichoderma* species is high only with some plant species that is root exudates of some plants may induce or inhibit mycelial growth of certain *Trichoderma* species only. Pea and maize root exudates strongly induced the mycelial growth of *T. longibrachiatum, T. harzianum* and *T. viride*. However, the increasing effect on the mycelial growth by the lettuce root exudates was only slight for the above mentioned *Trichoderma* species. The mycelial growth was completely inhibited by the exudates of onion and cabbage for the *Trichoderma* species above. [3, 13].

Lettuce (*Lactuca sativa*) and cucumber (*Cucumis sativus)* is grown widely around the World and those are popular vegetables in Latvia. Therefore the aim of this study was compared the effect of *Trichoderma viride, Trichoderma lignorum* on the growth, yield formation and quality of lettuce and cucumber and soil biological parameters were plants were grown.

MATERIAL AND METHOD

Experiments were carried out in the greenhouse of Institute of Soil and Plant Science, Faculty of Agriculture, Latvia University of Agriculture.
Lettuce (*Lactuca sativa*) cv.'*Grand Rapids'* and cucumber (Cucumis sativus) cv. *'Pioneer'* were grown in 1L vegetation pots. After three weeks cucumbers were transplanted into 10 L vegetation pots. Vegetation pots were filled with peat substratum and one plant per pot planted. Three days before planting, commercial peat substratum (pH_{KCl} 5.5 ± 0.5, N 100 - 140 mg L^{-1}, P_2O_5 110 - 170 mg L^{-1}, K_2O 190 - 290 mg L^{-1} with Ca, Mg, S and microelements: Fe, Mn, Mo, Zn, Cu and B) was mixed with microorganisms *Trichoderma viride, Trichoderma lignorum* given by the Institute of Microbiology and Biotechnology, Latvia University. Control - without additional microorganisms. *Trichoderma viride, Trichoderma lignorum* was added as liquid culture in concentration 20 and 100 mL per square meter and labelled TV20, TV100, TL 20, TL100. Used concentrations were recommended by producers.
After 20 and 40 days of experiment plant fresh and dry weight, content of dry matter, pigment and ascorbic acid content in leaves, antiradical activity of plants was determined. Pigment content was determined spectrophotometricaly in ethanol extract [6].
Soil enzymatic activity (catalase, dehydrogenase) was detected spectrophotometricaly, soil respiration activity with Gas Analyser ADC 2250 at the end of experiment. Dehydrogenase activity was determined by reduction of 2-*p*-iodo-3-nitrophenyl-5-phenyltetrazolium chloride to iodonitrophenylformazan at 30 °C. [5; 12]. Activity of catalase was determined by measurement of produced oxygen in enzymatic decomposition of hydrogen peroxide to water and oxygen [7; 12]. Intensity of soil respiration was determined by measurement of emissioned carbon dioxide [7; 12].
Analyses of variance (ANOVA) and correlation were performed.

RESULTS AND DISCUSSIONS

Trichoderma lignorum stimulated vegetative growth of lettuce plants. Both preparations dose 100 mL m^{-2} increased plant fresh weight in comparison with control (Fig.1). The highest dry matter content in lettuce leaves was observed in variant with *T.viride* in larger concentration.

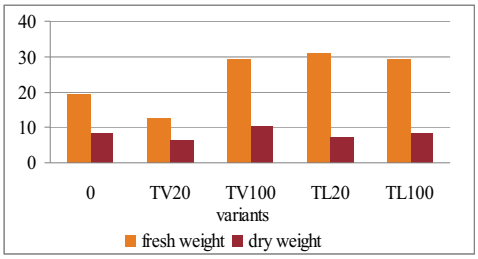

Fig. 1. Fresh weight (g) and dry weight (%) of lettuce leaf in the end of experiments

The increased level of chlorophylls was observed in cucumber leaves as effect of *Trichoderma lignorum* (Fig.2). However, lettuce leaves show different effect. Level of chlorophylls decrease in the variants with higher microorganisms dose (Fig.3).

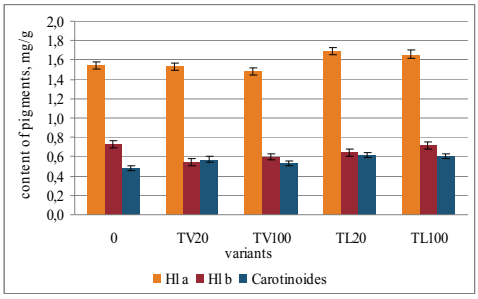

Fig. 2. Content of pigments in the cucumber leaves

Decreased level of chlorophyll b was observed in the lettuce leaves as result of microorganisms preparation use and it causes changes in the chlorophyll a and b ratio. The lowest ratio was observed in control (2.12 for cucumber leaves and 2.87 for lettuce leaves. Plant species had different sensitivity to additional microorganisms.

Effect of preparation depended on plant development stage. Data statistical analyses didn't approve the significant effect of additional microorganisms on dry matter content in lettuce leaves.

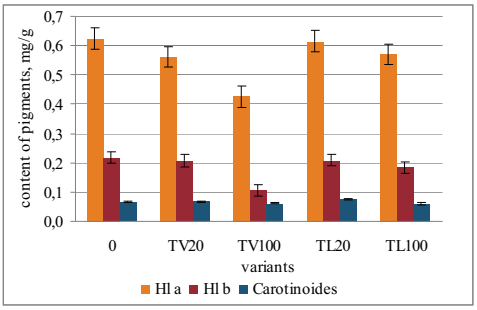

Fig. 3. Content of pigments in the lettuce leaves

Peat substratum without plants showed decreased soil respiration intensity (Fig.4.), but increased dehydrogenase activity. During experiment was determined different interaction between plant and microorganisms. Higher respiration intensity of peat substratum of lettuce was determined in variants with additions *T. viride*, but in the experiment with cucumber in the variants with *T. lignorum* (TL100) (Fig.4.).

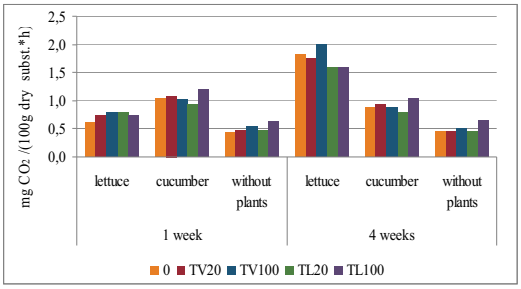

Fig. 4. Respiration intensity of peat substratum

Soil respiration intensity changed also during plant vegetation. At the beginning of experiment substratum were cucumbers grow showed larger activity, but after 4 weeks of cultivation "lettuce" soil became more active (Fig.4).

Microorganisms' preparations differently affect soil enzymes activity (Fig.5. and Fig.6.).

Dehidrogenase activity was affected more significantly than fluoresceine diacetate (FDA) hydrolysis intensity. Addition of *Trichoderma* essentially decreases activity of dehydrogenase, except higher dose of *T.lignorum*. Fluorescein diacetate (FDA) hydrolisys intensity have trend to increase in variants with higher dose of additional microorganisms.

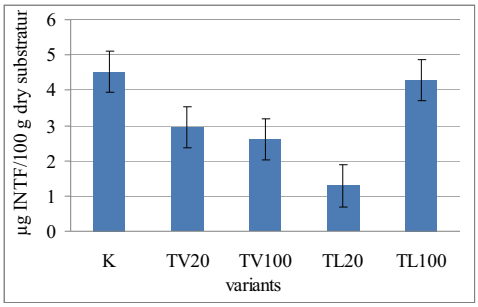

Fig. 5. Dehidrogenase (DH) activity of cucumber peat substratum at the end of experiment

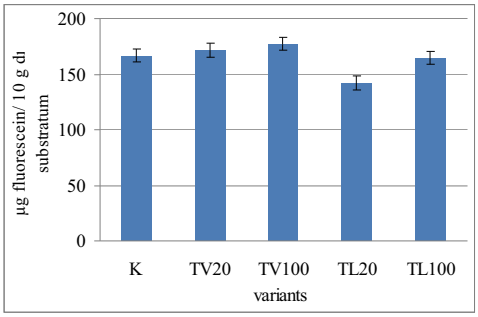

Fig. 6. Fluorescein diacetate (FDA) hydrolisys intensity of cucumber peat substratum at the end of experint

Strong negative correlation was observed between used microorganisms' dose and chlorophyll concentration in lettuce leaves, but for cucumber leaves that correlation was insignificant. Positive correlation was observed between plant dry matter and soil respiration intensity and chlorophyll b content in plants and soil enzymatic activity.

In average *T.lignorum* was more suitable for lettuce and cucumber cultivation and should be recommended for growers.

CONCLUSIONS

1. Significant increase of lettuce fresh weight was observed with addition of *Trichoderma lignorum* dose 20 g m^{-2} in peat substratum before lettuce planting.
2. The increased level of chlorophylls was observed in cucumber leaves as effect of *Trichoderma lignorum.*
3. Plant species had different sensitivity to additional microorganisms. Effect of preparation depended on plant development stage.
4. Increase of substratum respiration intensity as result of addition of microorganisms was observed.

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