EFFECT OF AZOTOBACTER PRODUCTS ON LETTUCE TRANSPLANTS

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ABSTRACT
While the nutrient supply in conventional farming is mainly provided by fertilizers, the organic farmers have to use nutrient-rich organic materials to produce seedlings of high quality.
The advantage of transplants use in the vegetable growing can be to realize earliness (it gives higher benefit), increase growth safety, etc. Effect of bacteria (like microbial agent) can transform faster the nutrients from organic material. It can give opportunity for organic manure to affect faster in the substrate.
The aim of this research was to determine: growing lettuce seedling only with the use of organic materials, estimating the effectiveness of some microbial products in vegetable transplant growing, and effect of microbial products on efficiency of manures.
The results show that the combination of organic fertilizers and soil bacteria has effect on the increasing of nitrogen up-take of plants.

Key words: seedling, transplant growing, microbial product, azoto bacteria, manure

INTRODUCTION

The farming that use high amount of energy input resulted with outstanding growth of yield. However, at the same time negative symptoms intensified that directly affect global production and human living conditions as well. Among these kind of environmental risks MAHLER ET AL (1994) suggested the maximization of N utilization efficiency that is an increasingly important objective in most of the cropping systems. That could be achieved by energy-intensive land use, the direct energy input (e.g. fuel use) and indirect energy input (such as fertilizer use) (MONTEMURRO AND MAIORANNA, 2009). Besides this, while the nutrient supply in conventional farming is mainly provided by fertilizers, the organic farmers have to use nutrient-rich organic materials to produce high quality of seedlings (PAP AND TOBIAS, 2009).
Experiences of the past few years proved that seedling production has particular importance. It can give chance to increase earliness, extend the growing period and increase crop safety. Moreover, it allows better utilization of growing area as well as the transplant growing use the expensive seeds reasonably (used seeds per hectare may significantly reduce) (PAP, 2011). Because of controlled climate conditions, not only the productivity of the plants, but the quality of yield will be also adequate (MONTEMURRO AND MAIORANNA, 2009). Disadvantages that should be mentioned are the costs of extra work and sustenance (KAPPEL, 2006).
According to SALEH ET AL. (2010) the organic manure is really important for the substrate productivity in seedling growing. The effect of chemical fertilizers can be faster in some cases, but the organic fertilizers are mostly more effective and the influence is also longer. In their experiment the 50-50% organic-chemical fertilizer gave highly similar results as chemical fertilizer alone.

Organic manures can be more efficacious with using microbial products that may include many kinds of organisms. The revealed processes can be geared up by bacteria (INGHAM ET AL., 1985).

Bacteria are a kind of micro-organism which can adsorb 100-1000 times bigger amount of material than his normal weight in 1 day under favorable conditions. In this case the incoming organic material of soil can be demolished in a few days. They have essential function in nitrogen cycle (STEFANOVITS, 1992).

According to the technology of soil treatments by liquid bacteria products, the most important agent can be bacteria adsorbing the atmospheric molecular nitrogen. *Rhizobium* species are the most important of them, which live together with plants from the *Fabaceae* family. Another germ (*Azotobacter chroococcum*) lives independently of other living organisms, and it can adsorb nitrogen, too (INGHAM ET AL., 1985).

Some of the literatures talk about effective use of microbial products. According to MAROZSÁN (2012), bacterium products can be suitable for decreasing the amount of chemical fertilizers. In his experiment he proved that the use of Phylazonit® MC (microbial product; WEB 1) could increase weight of roots and shoots of young corn and cucumber plants. Bacterium treatment increased tolerance of plants in toxic environment (high aluminium, Al content in soil) as well.

The subject was based on the idea of easy mixing peat substrate with granulated organic fertilizer, which can be easily manageable by other microbial products that can increase the effectiveness of organic fertilizer.

MATERIAL AND METHODS

Material

The experiment was set in the greenhouse of the Central Arboretum of Buda of the Corvinus University of Budapest, Faculty of Horticultural Science, Department of Vegetable and Mushroom Growing, between November 2011 and February 2012.

Used materials:

Lettuce seed - Pantlika (LS10224) **-** forcing lettuce varieties (by Syngenta Seed Company) (WEB 2); ***KITE polystyrene tray*** for transplant growing, number of cells: 60; ***Perlite*** *(Perlite Pannonia Ltd.)* - horticultural perlite with 0-6 mm particle size; ***Novobalt Peat*** (Natur Lithuanian peat) - pH: 3,5-4; ***Italpollina*** **-** organic fertilizer from chicken manure. This material contains high level of nitrogen, phosphorus and potassium, and amino acids, humic, and fulvol acid compounds (WEB 3); ***Natur terra*** **-** Microbial product, that active substrates are soil bacteria species (WEB 4); ***TEAM*** (trial material without Hungarian distribution permission) - active agents: mycorrhizal fungi *(Glomus intraradices, Glomus mosseae)*, organic materials, rhizosphere bacteria, and *Trichoderma atroviride* (WEB 5); ***Lime*** (for right pH balance).

As shown in *Table 1*, six treatments were tested in the experiment. The experiment was set up according to the trial scheme with 3 repetitions (1 repetition meant 60 lettuce seedlings).

Table 1. Treatments and marking during experiment (2012)

Treatment 1.	(Tray 1-3) Control (K)
Treatment 2.	(Tray 4-6) Peat & TEAM (2 g/treatment) (TA)
Treatment 3.	(Tray 7-9) Peat + Natur terra (1.2 ml/treatment) (TN)
Treatment 4.	(Tray 10-12) Peat + Italpollina (75 g/tray) (TTR)
Treatment 5.	(Tray 13-15) Peat + Italpollina (75 g/tray) + TEAM (2 g/treatment) (TTrA)
Treatment 6.	(Tray 16-18) Peat + Italpollina (75 g/tray) + Natur terra (1,2 ml/treatment) (TTrN)

Table 2. Nutrient values of used substrates

1 = Control, 2 = Peat + TEAM, 3 = Peat + Natur terra, 4 = Peat + Italpollina, 5 = Peat + Italpollina + TEAM, 6 = Peat + Natur terra + Italpollina T = Peat, Peat + TTR = Italpollina, Tr = Italpollina

Marking	K_2O mg/kg	NO_3-N mg/kg	P_2O_5 mg/kg	pH	EC mg/kg
1	122	0.32	641	5.24	0.986
2	128	0.484	654	5.39	0.827
3	167	0.466	685	5.99	0.793
4	1730	0.826	2850	5.58	1.45
5	993	1.99	2560	5.8	1.3
6	644	2.04	1370	6.1	0.742
T	374	1.15	52.5	6.75	0.767
TTr	912.5	60	2955.72	5.72	0.999
Tr	26400	41	12200	n/a	n/a

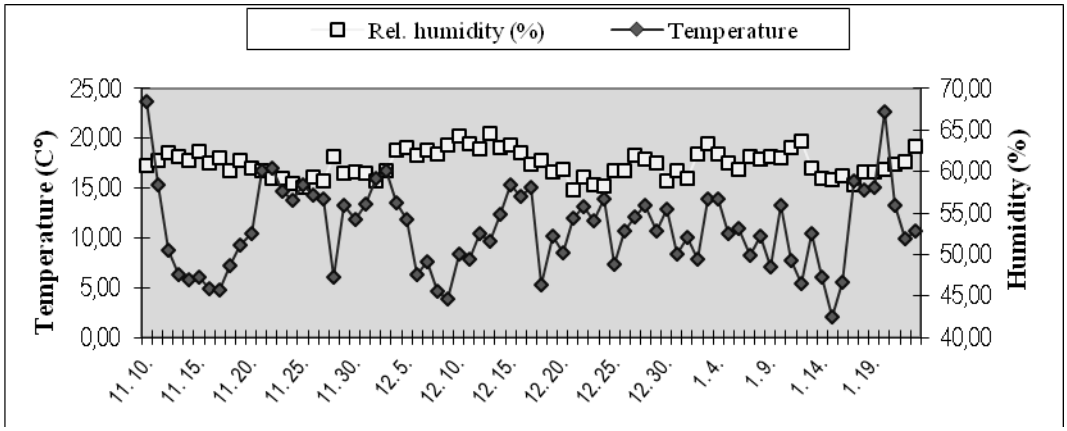

Figure 1. Measured daily average temperature and humidity in glasshouse

Measurements

The following parameters were determined:

- Dry matter content of roots (calculated from fresh and dry weights)
- Dry matter content of greenery (calculated from fresh and dry weights)
- Plant height till top of longest leaf
- Photosynthetic rate (with use of LCi measurer)
- Chlorophyll content from measured SPAD values

RESULTS AND DISCUSSION

In this experiment all chicken manure treated transplants were more developed than the non-treated ones. It is observable in *Figure 2*, *Figure 4* and *5*, that was measurable different between two groups. Although dry matter contents (in root and in greenery) couldn't give same 'image', it may identify an inverse proportion between *Figures 2*, *4*, *5* and *Figure 3*. According to KAPPEL (2006), higher content of dry matter is traceable in those seedlings which are under some stress factor (such as dry or cold conditions or disturbed nutrient uptake). In *Figure 1*. can be traceable a massive stress, the low daily average temperature in intensive growing phenophase. In the first, second and third treatment any manure was not used, this cold environment without enough nutrient was enough factor to prove KAPPEL'S (2006) statement.

Still, measured photosynthetic rate was not higher in 2nd and 3rd treatment and chlorophyll content was less as well. Interestingly, the SPAD chlorophyll content was depressed in treatment 4 (peat + composted chicken manure), but there was found the highest value of measured photosynthetic rate in parallel with treatment 5. Photosynthetic rate and SPAD values of chlorophyll content wasn't into correlation significantly, however different of groups of our treatments (with or without manure) can be traceable.

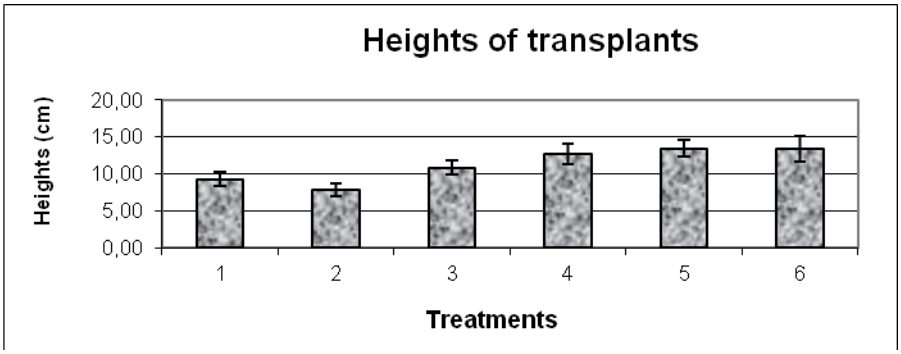

Figure 2. Heights of lettuce transplants

Used symbols: 1 = Control, 2 = Peat + TEAM, 3 = Peat + Natur terra, 4 = Peat + Italpollina, 5 = Peat + Italpollina + TEAM, 6 = Peat + Natur terra + Italpollina

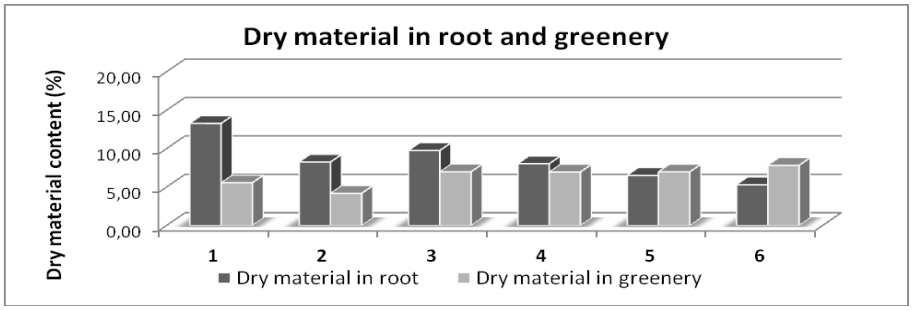

Figure 3. Calculated dry material in lettuce seedlings

Used symbols: 1 = Control, 2 = Peat + TEAM, 3 = Peat + Natur terra, 4 = Peat + Italpollina, 5 = Peat + Italpollina + TEAM, 6 = Peat + Natur terra + Italpollina

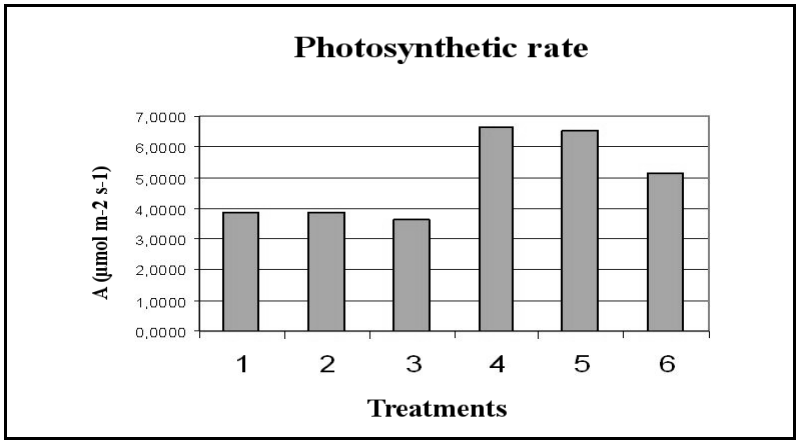

Figure 4. Measured Photosynthetic rate (A) on lettuce leafs

Used symbols: 1 = Control, 2 = Peat + TEAM, 3 = Peat + Natur terra, 4 = Peat + Italpollina, 5 = Peat + Italpollina + TEAM, 6 = Peat + Natur terra + Italpollina

The higher values of photosynthetic rate in treatments 4, 5, 6 can be observed in *Figure 4*. Moreover, secondly measured SPAD values gave exactly higher results according to *Figure 5*.

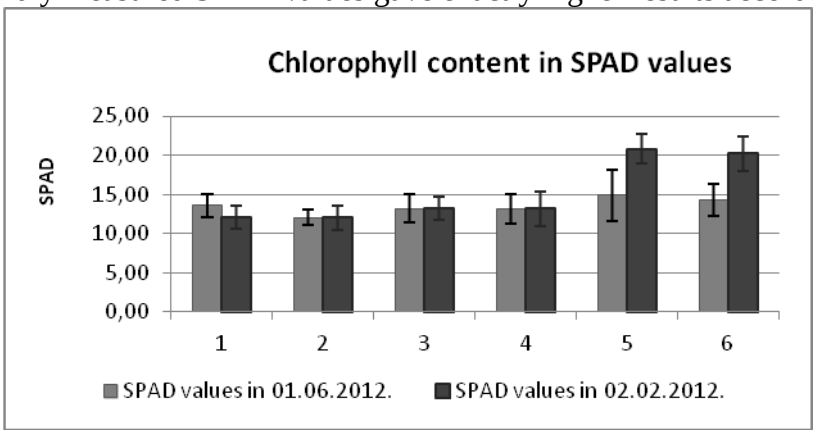

Figure 5. Measured Chlorophyll content in SPAD values on lettuce leaves

Used symbols: 1 = Control, 2 = Peat + TEAM, 3 = Peat + Natur terra, 4 = Peat + Italpollina, 5 = Peat + Italpollina + TEAM, 6 = Peat + Natur terra + Italpollina

In brief conclusion, microbial agents can generate bigger greenery, higher amount of chlorophyll content, better nutrient and water up-take that can help to increase photosynthetic activity too.

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