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Improvement Quality and Content of Pepper and Chilli Nitrates Influenced by the Effective Microorganisms

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Abstract

EM microorganisms are able to increase the soil microfauna, leading to an improvement in field production. Photosynthetic bacteria, contained in Em microorganisms, can in fact, in synergy with other microorganisms, improve the absorption of nutrients from the soil and reduce the incidence of disease. The objective of this trial was to evaluate the influence of EM microorganisms on growth and nitrate content on pepper and chilli plants. The treatments carried out were: 1) use of EM microbial selection; 2) plants irrigated with water. In all the experiments carried out, the pepper and chilli plants treated with EM were significantly higher and had larger stems than those treated with water. The use of EM micro-organisms can therefore lead to an increase in production quality and a reduction in nitrate content on pepper and chilli plants.

Keywords: EM; vegetables; plant quality; symbiotic bacteria; nitrates.

1. Introduction

EM microorganisms include a mixture of live cultures of microorganisms, aerobic and anaerobic naturally isolated from fertile soils, which are used during plant cultivation and can have numerous benefits for humans, animals and the environment [11],8]. EM microorganisms include lactic acid bacteria, photosynthetic bacteria, yeasts and other soil bacteria. Lactic acid bacteria are *Lactobacillus casei*, *Lactobacillus plantarum* and *Streptococcus lactis*. The photosynthetic bacteria from *Rhodopseudomonas palustrus* and *Rhodobacter spaeroides*. There are also *Saccharomyces cerevisae*, *Candida utilis*, *Streptomyces albus* and *Streptomyces griseus*, *Pseudomonas sp.*, *Aspergillus oryzae*, *Penicillum sp.*, *Mucor hiemalis* for a total of 80 different strains that perform different functions in collaboration [2,5,10].

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The products based on Effective Microorganisms, given the microbial multiplicity may contain various organic acids, antioxidants, enzymes and chelates. EM was initially selected as an alternative to agricultural chemicals, but extensive research and field trials allowed its successful application in other sectors, including environmental remediation, composting of organic waste, odour reduction in livestock farming and treatment of polluted water [12].

EM microorganisms are capable of stimulating plant growth and solubilising the mineral elements present in the soil, in particular Ca, P and Mg. Ca influences many beneficial processes for the plant: a high content of Ca leads to fewer diseases, reduction of attack by insects, better preservation of the product [7].

Research on the application of EM microorganisms on different cultivated plants has shown that these microorganisms at agronomic level can significantly influence seed germination, plant vigour, leaf photosynthesis, early fructification, plant height, number of fruits [1,13,14,6,3,12].

The aim of this experiment was to evaluate the influence of EM microorganisms on the improvement of the production quality of pepper and chilli plants.

2. Materials and methods

The experimentation started on March 15, 2018 in a heated greenhouse located near Rosignano Solvay (LI). The variety of peppers (capsicum annum) 'Mantovano' and chilli (chinense) 'HOT Short cayenne Eris F1' have been grown. The treatments carried out were: 1) use of EM microbial selection; 2) plants irrigated with water. The substrate used for the cultivation was a mixture of peat and pumice fertilized with NPK Original Gold® 15-9-15 (+2), 3g per litre of substrate. Plants were soaked in EM 1:200 (treatment 1) or water (treatment 2) for 1 hour before transplantation. The growing substrate was also treated with EM (1:200) and water before implanting the plants.

Once a week after transplantation, the plants were irrigated with an activated EM 1:100 solution (treatment 1) or with water (treatment 2) using 12 L of liquid for 50 plants in each treatment. Each treatment included 50 plants, distributed in 5 replicas by 10 plants grown simultaneously. The lighting of the greenhouse at system level was about 12,000 lux from high-pressure sodium lamps, illuminated for 20 hours a day. Minimum daytime and night-time temperatures were 24°C and 14°C respectively.

The height of the plants and the diameter of the stems of the pepper and chilli plants were evaluated. The nitrate content was also evaluated with SOEKS NITRATESTER.

Variance analyses were carried out on the data obtained with the Costat programme.

3. Results

The evidence is that the pepper and chilli plants treated with EM were significantly higher than those with water, 23, 62 and 20, 81 cm respectively in plants treated with Effective Microorganisms compared to 17.93 and

16.70 cm in water-irrigated plants (fig. 1a-2a).

The diameter of stem plants treated with EM was larger than that of plants irrigated with water, both in pepper and chilli, 1.6 cm and 0.84 cm in EM compared to 0.71 cm and 0.54 cm for water-irrigated plants respectively (fig. 1b-2b).

The fresh weight of the pepper and chilli berries has significantly increased in the EM-treated theses compared to those irrigated with water, 138.56 g compared to 121.90 g in pepper and 33.93 g compared to 26.02 g in chilli (fig. 1c-2c).

The nitrate content in control plants is significantly higher than those grown with EM, 3868,34 mg/Kg and 3205,80 mg/kg in the control for pepper and chilli, compared to 2977 mg/Kg and 2067,92 mg/Kg in plants treated with Effective microorganisms respectively.(fig. 1d-2d)

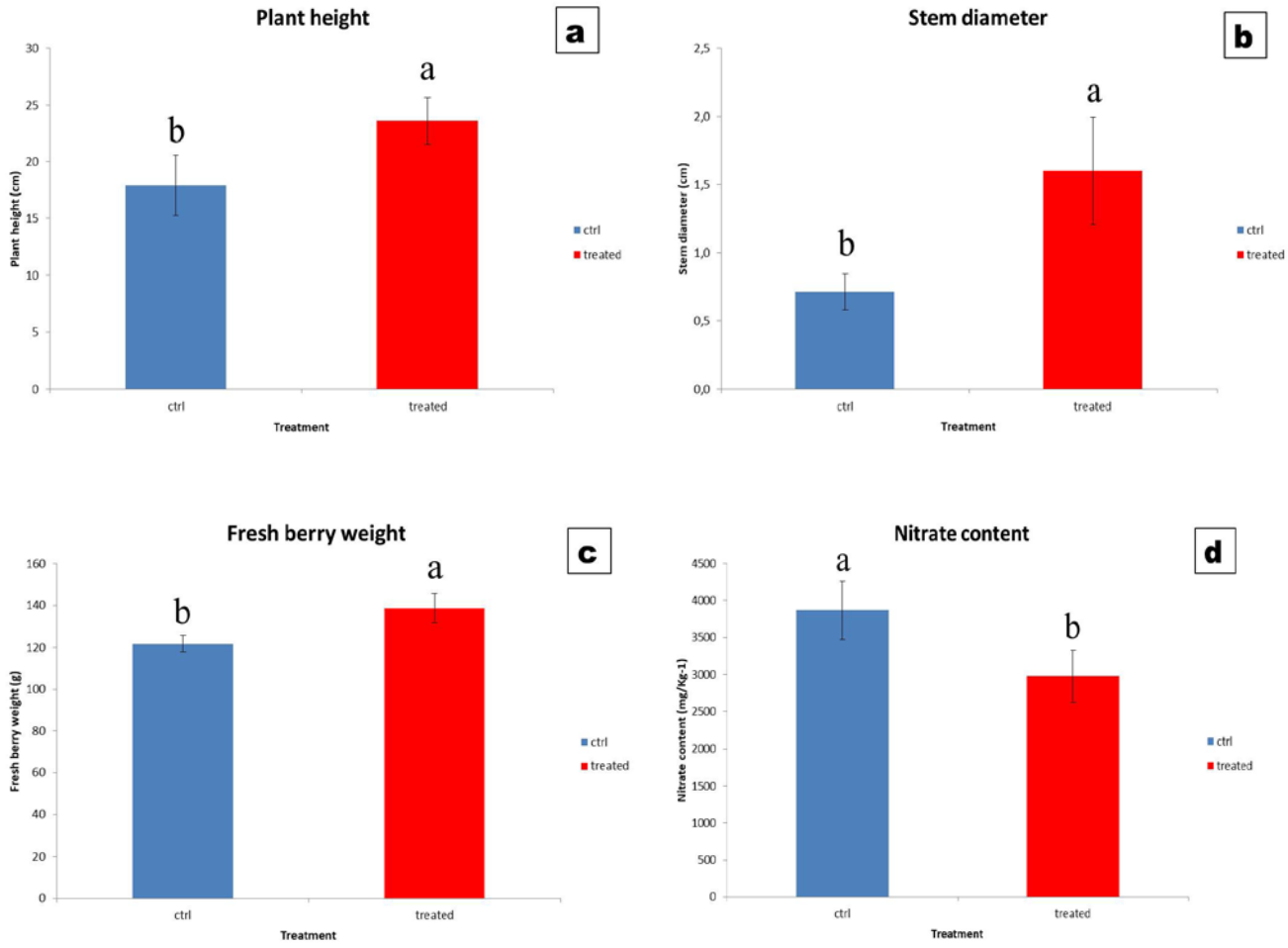

Figure 1: Effect of EM on plant height (a), stem diameter (b), fresh berries weight (c), nitrate content (d) in pepper plants.

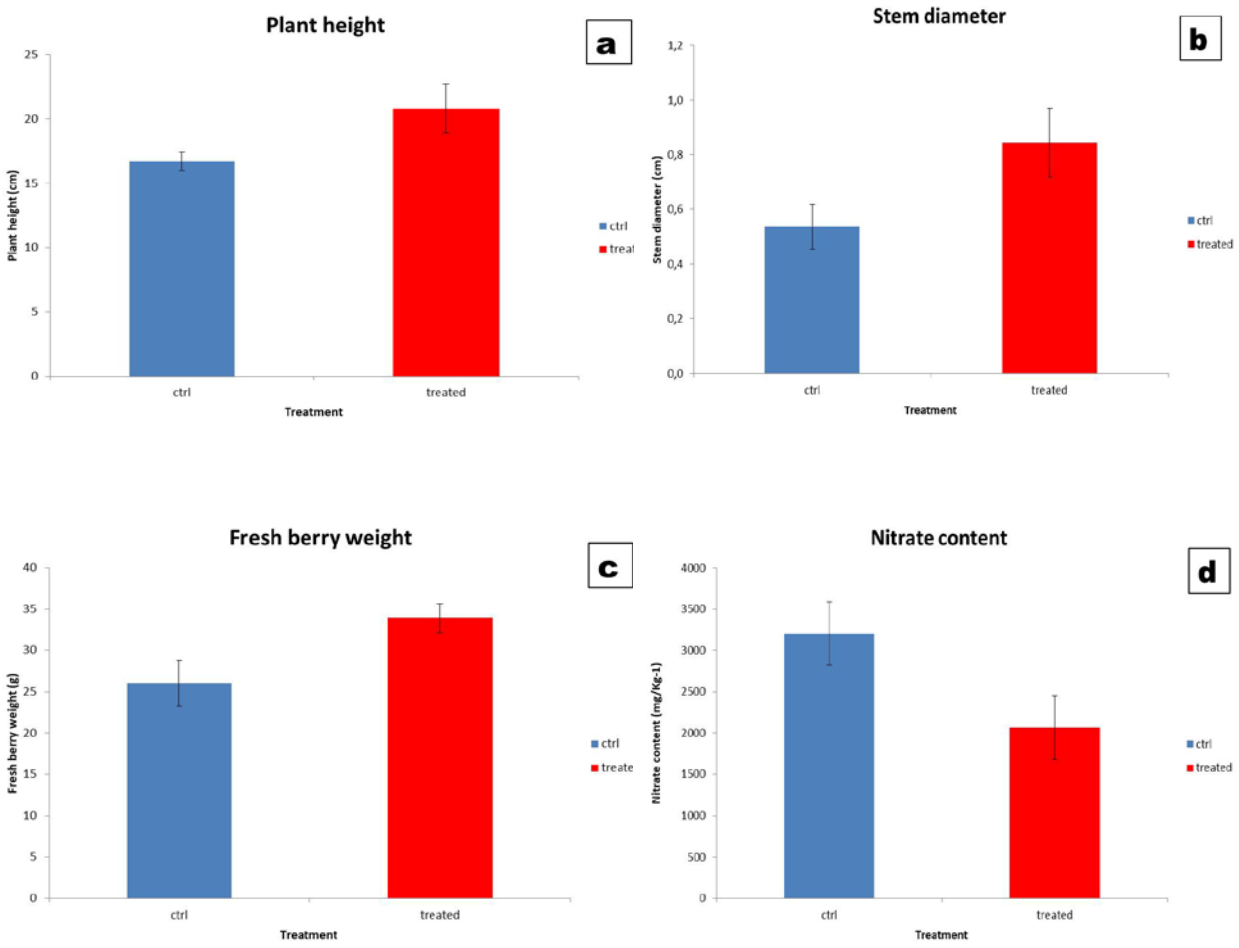

Figure 2: Effect of EM on plant height (a), stem diameter (b), fresh berries weight (c), nitrate content (d) in chilli plants

4. Discussion

The test has shown an increase in the height and thickness of the stem in pepper and chilli plants, aspects that can guarantee the plant a greater supply of water and minerals, in particular calcium. Appearance also showed in tomato and pumpkin plants [8]. Higher calcium content reduces the incidence of insect disease and improves the quality and preservation of fruit and vegetables [9].

Em has determined an improvement of the productive quality of tomatoes and pumpkin, even if in literature in many cases Effective microorganisms can have a negative influence, reason probably due to a immobilization of nitrogen by microorganisms [6,7].

Some scientists have shown that EM can increase fruit weight, yield, photosynthesis [3]. Em applied with green manure significantly increased tomato yields and in the third year were comparable to those obtained with chemical fertilizers [4]. The nitrate content was lower in EM-treated pepper and chilli plants than in control.

This could represent a desirable and important effect on their quality, aspect already noted in pumpkin and cucumber by Olle [8]

The reason could be that the immobilisation of nitrogen by EM causes a reduced availability of nitrogen for plants. Although less nitrogen is available, the pepper and chilli plants treated with EM are higher, have a thicker stem and a higher fresh weight of the berries.

5. Conclusion

The results show that EM microorganisms improve the quality of pepper and chilli plants, in particular by increasing the height, stem diameter and fresh weight of the berries. In plants treated with Effective microorganisms, a significant reduction in nitrate content is evident, but this does not affect plant quality. Microorganisms are likely to have a positive effect on the absorption of other minerals, particularly calcium, by promoting plant growth. Further studies will be carried out on other plants to confirm this hypothesis.

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