YIELD, MORPHOLOGICAL AND PHYSIOLOGICAL COMPARATIVE ASPECTS IN *OCIMUM BASILICUM* L. UNDER DIFFERENT FERTILIZATION TYPES

ASPECTE COMPARATIVE DE PRODUCȚIE, MORFOLOGIE ŞI FIZIOLOGIE LA *OCIMUM BASILICUM* L. SUB DIFERITE TIPURI DE FERTILIZARE

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Abstract. *The aim of this paper is the comparative evaluation of various types of fertilizers on yield and some physiological parameters of basil plants, cultivated by direct seeding in the field, without irrigation, under the experimental conditions from V. Adamachi farm of U.S.A.M.V. Iaşi. The applied fertilizers were: organic (Orgevit - 600 kg/ha), chemical (N: P: K 20:20:20 - 300 kg/ha), microbial (Mycoseed - 30 kg/ha) and municipal sludge in two doses (40 t/ha and 20 t/ha). Regarding the production of fresh herba, chemical and microbial fertilization led to the highest values, increased with 38% and 19% respectively compared to controls. Similarly, dry mass production increased under the same types of fertilization by 34% and 28% respectively. The number of lateral stems also increased in plants fertilized with municipal sludge and microorganisms. In terms of assimilatory pigments content, higher than the control values were recorded with sludge (40 t/ha), organic and chemical fertilization. In conclusion, fertilization with microorganisms and municipal sludge can be a viable and sustainable alternative to chemical fertilizers for the cultivation of basil.*
Key words: fertilization, municipal sludge, morphological indices, assimilatory pigments contents

Rezumat. *Scopul prezentei lucrări este de a evalua comparativ unii indicatori de producție şi fiziologici ai busuiocului cultivat prin semănare directă în câmp, fără irigare, dar fertilizat cu patru tipuri de îngrăşăminte: ecologice (Orgevit – 600 kg/ha), chimice (N:P:K 20:20:20 – 300 kg/ha), microbiene (Mycoseed – 30 kg/ha) şi nămol municipal în două doze (40 t/ha, respectiv 20 t/ha). Fertilizarea chimică şi cea cu microorganisme au determinat cele mai mari creşteri de producție, cu 38%, respectiv 19%. Similar producția de masa uscată a înregistrat cele mai mari valori pentru aceleaşi tipuri de fertilizări, crescând cu 34%, respectiv 28% față de varianta martor. Numărul de ramificații a crescut la variantele fertilizate cu microorganisme şi cu nămoluri municipale.*

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Conținutul de pigmenți asimilatori, a avut valori mai mari față de martor la fertilizarea cu nămol (40 t/ha), cea chimică şi cea organică.
Cuvinte cheie: fertilizare, nămoluri municipale, indici morfologici, pigmenți asimilatori

INTRODUCTION

Basil (*Ocimum basilicum* L.) is a valuable aromatic, medicinal and culinary herb, cultivated in many areas around the world, widely used in traditional remedies and medicine, the perfume and food industry, cosmetics, organic farming and landscaping (Paton *et al*., 1999; Stan, Stan, 2006; Stefan *et al*., 2013; Burducea *et al*., 2015; Onofrei *et al*., 2016). Recently researchers demonstrates the capacity of using basil extracts for the amelioration of AIDS and cancer (Pandey *et al*., 2014; Cernei, Ciocârlan, 2013; Stan *et al*., 2003). Moreover, the antimicrobial capacity of basil is very useful for the preservation of foods and combating some pathogenic fungi and bacteria. The bioactivity of basil, is driven especially by its chemical composition, the aerial parts of basil producing essential oil and substances with antioxidant activity, phenols etc. Also, the large number of varieties with diverse colors and fragrances increase the attractiveness of this plant (Zamfirache *et al*., 2008; Burzo, 2015).

In terms of fertilization, the goal of scientist is to find sustainable alternatives to the chemical ones, in order to protect the environment and human health. Example of green fertilizers are animal manure and sewage sludge (biosolids). Biosolids, which results in large amounts approx. 10 million tones dry substance in European Union (Eurostat, 2016) are the byproduct of waste water treatment plants. This biosolids contain important amounts of organic matter, micro and macro nutrients which make it suitable for the use in agriculture and restoration of some degraded arable lands (Holz *et al*., 2000). The aim of this paper is the comparative evaluation of various types of fertilizers on yield and some physiological parameters of basil plants.

MATERIAL AND METHOD

Ocimum basilicum L. seeds cv. Creţişor (fig. 1) were provided by the Botanical Garden of Chisinau, Republic of Moldova and were directly seeded in the field without irrigation, under the experimental conditions from V. Adamachi farm of USAMV Iasi.

The applied fertilizer were: control, organic (Orgevit - 600 kg/ha), chemical (N: P: K 20:20:20 - 300 kg/ha), microbial (Mycoseed - 30 kg/ha), municipal sludge in two doses (40 t/ha and 20 t/ha). Plants were harvested at the flowering stage. Fresh yield and dry yield was assessed by weighing five plants per each variant of fertilization.

Assimilatory pigments were measured with a non-destructive portable chlorophyll content meter (SPAD 502 Minolta, Japan) that measures optical absorbance, the readings being expressed as SPAD units on five leaves (from the lower, middle and upper regions of the plants) from three individuals each per treatment.

Fig. 1 Basil cv. Creţişor

The statistical analyses conducted were represented by analyses of variance among treatments and the Tukey post hoc test at $p<0.05$, the results being expressed as means and standard errors.

RESULTS AND DISCUSSIONS

Adamachi research Farm of Iasi, without irrigation. The fresh yield of the Cretisor plants increases with 38% and 19% in the case of chemical and microbial fertilization respectively. Similarly, dry yield increased under the same types of fertilization by 34% and 28% respectively. Regarding the number of lateral stems, plants that were fertilized with municipal sludge and microorganisms recorded the highest values (tab. 1).

Sewage sludge, organic and chemical fertilization lead to an increased assimilatory pigments content in leaves compared to the control plants (fig. 2). Similar results were obtained for other species, under sewage sludge treatments, with significant positive influences on similar parameters but also for basil (Costa *et al*., 2010, Kashani *et al*., 2013).

Table 1

Yield and lateral stems of basil cv. Creţişor cultivated under different types of fertilization

Fertilizer	Fresh yield (g/plant)	Dry yield (g/plant)	Lateral stems (no.)
Control	25.8[a]±2.24	37.1[a]±0.06	12.67±0.88
Organic	27.6[a]±1.57	36.81[a]±0.04	13±1.15
Chemical	35.8[b]±5.4	42.41[c]±0.07	11.33±0.33
Microbial	36.8[b]±4.72	40.45[b]±0.07	12.67±2.19
Sludge (40 t/ha)	24.4a±4.41	39.78[b]±0.16	12.33±0.33
Sludge (20 t/ha)	26.6[a]±3.91	39.64[b]±0.06	12.33±0.67

Different letters between treatments represent statistical differences for p ≥ 0.05

Increased chlorophyll contents in sludge amended plants may be the result of higher nitrogen levels in substrate. Although, some species may display reduction of chlorophyll contents under sludge amendment, this may be due to metal toxicity (Singh and Agrawal, 2007).

Other research regarding the beneficial effect of utilizing sewage sludge for the fertilization of crops in Romania, sustain its usefulness especially for the high amounts of macronutrients which improves soil quality that leads to greater yield. For Instance, Stan (1996) in a two year study, 1994-1996, reported an improved yield (199.9%) of maize cultivated on a soil amended with 10% sludge compost.

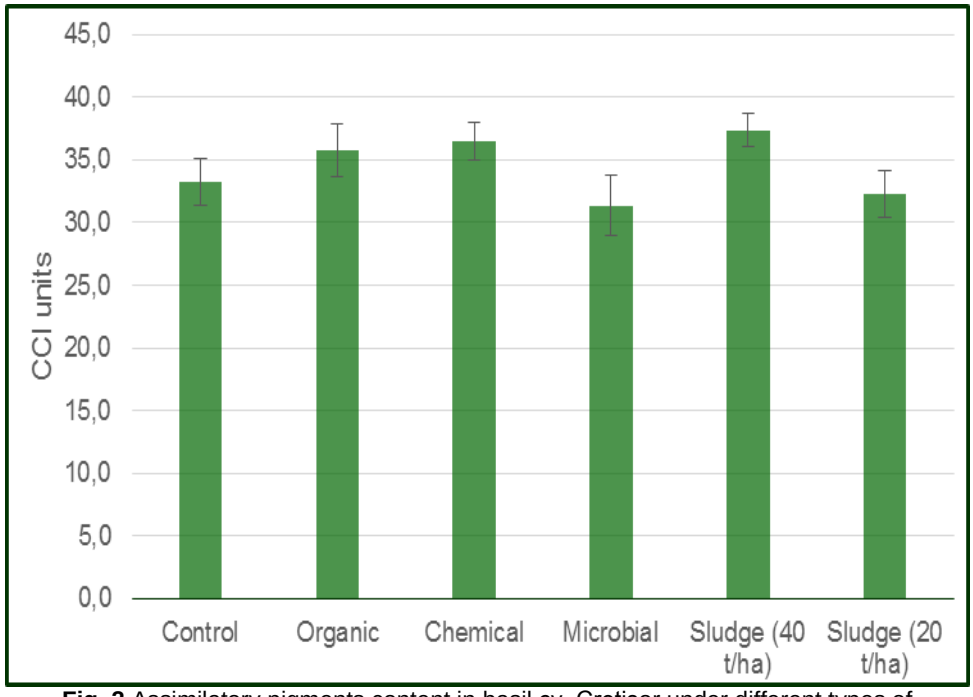

Fig. 2 Assimilatory pigments content in basil cv. Creţişor under different types of fertilization

CONCLUSIONS

1. Microbial fertilization increased fresh and dry yield of basil plants cv. Cretisor.

2. Assimilatory pigments contents were increased by the biosolids.

3. Fertilization with microorganisms and municipal sludge can be a viable and sustainable alternative to chemical fertilizers for the cultivation of basil.

4. Further research is needed in order to evaluate the effects of the selected fertilizers on the biochemical and physiological parameters of Cretisor cultivar.

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