SOIL MICROBIAL ACTIVITY IN AN ORGANIC EDIBLE ROSE CROP

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INTRODUCTION

- One of the most important activity in organic agriculture is maintaining and enhancing the soil health respectively the soil organic matter (IFOAM, 2010; Berca 2011; Reeve, 2007).
- The organic agriculture should be based on living ecological systems and cycles, work with them, emulate and help sustain them (IFOAM, 2010).
- Different kind of organic matter can bring additional positive effects on yield through amelioration of soil life, water retention, humus content (van Opheusden et al, 2012; Butcaru et al, 2016).
- An important component for increasing the soil fertility and health can be green manure, cover crops, living mulch (Crossland et al, 2015).
- Maintaining diversity is another important aspect for perennial cultures in organic agriculture is. Intercropping can be a way of increasing crop diversity (Andersen, 2005, Butcaru et al, 2016).

MATERIALS AND METHODS

The present paper presents the results of the microbiological activity in the soil after using an alternative and innovative method for improving the soil activity by using three ameliorative species: *Sinapis alba* L., *Tagetes patula* L. Sparky Mix and *Phacelia tanacetifolia* L., before and after the plantation of an organic edible rose culture. In addition to the three ameliorative species, from the first year of plantation, two kind of mulch was used: wood chips and wool.

The research analyses the evolution of bacteria, fungi population and respiration coefficient, measured before the establishment of the edible rose culture and after one year and reflect the potential of the ameliorative plants and mulch to develop and maintain the soil activity.

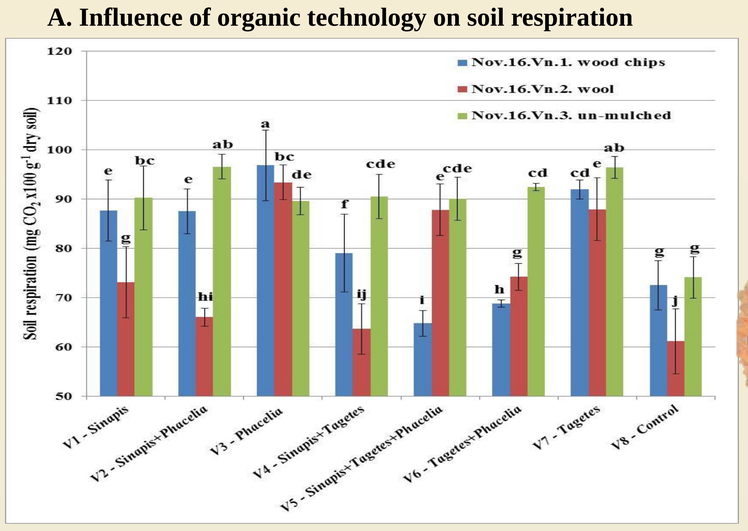
Crops were sown by combining the three species in 7 variants: V1 *Sinapis*, V2 *Sinapis* + *Phacelia*, V3 *Phacelia*, V4 *Sinapis* + *Tagetes*, V5 *Sinapis* + *Tagetes* + *Phacelia*, V6 *Tagetes* + *Phacelia*, V7 *Tagetes* and a control parcel V8, was kept as black field, without sowing.

Two mulching variants were applied for each initial variant (Vn), on the roses rows: Vn.1. wood chips and Vn.2. wool, while the control Vn.3., was represented by unmulched soil. The inter-row was kept grassy through repeated mowing.

For the analysis of the soil microbiological activity, samples were collected before and after planting the organic rose culture (from the total area in March 2015, from each variant Vn in July and October 2015, from each sub-variant Vn.1., Vn.2., Vn.3. in November 2016).

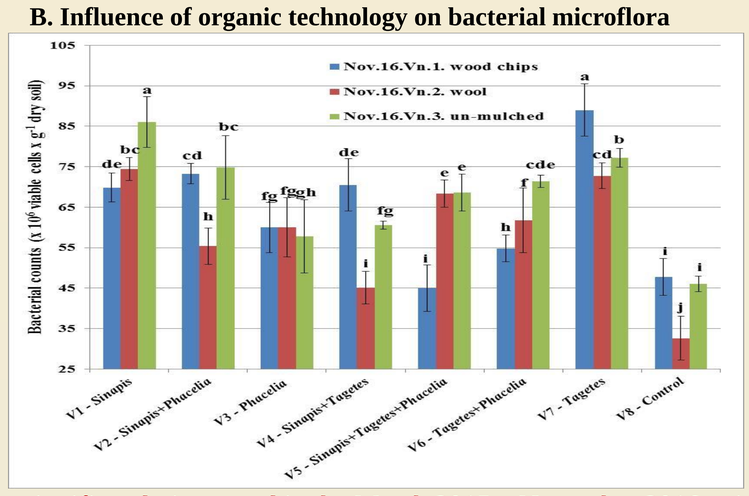
RESULTS AND DISCUSSIONS

A. Influence of organic technology on soil respiration



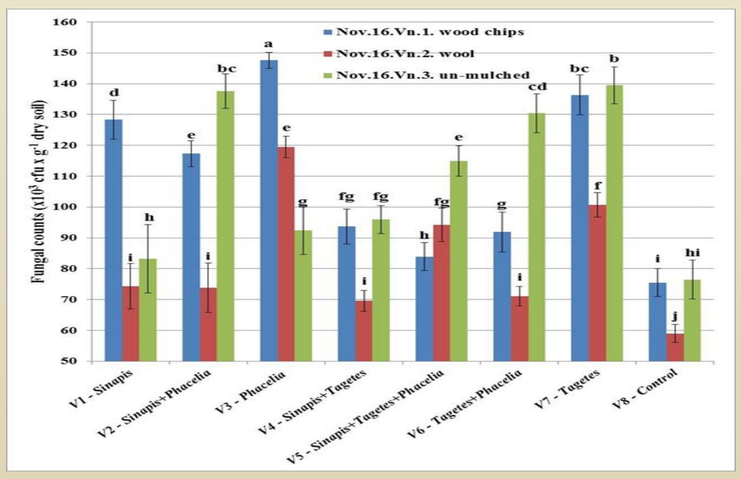
- a significant increase in soil respiration compared to controls, where recorded moderate values of released CO_2/100g dry soil.
- the most intense metabolic activities were recorded at V3.1. *Phacelia* with wood chips sub-variant, mainly due to the activity of cellulolytic fungi, at V7.1. *Tagetes* with wood chips sub-variant mainly on account of bacterial activities (actinomycetes in particular) and cellulolytic fungi, followed by variants with *Tagetes* as ameliorative plant (based on fungal microflora) or combinations of two species of ameliorative plants.
- in many of the variants with one or two species of ameliorative plants, soil respiration was more intense when it was used wood chips mulch compared to wool mulch but, in most cases, weaker or similar to the version un-mulched.

B. Influence of organic technology on bacterial microflora



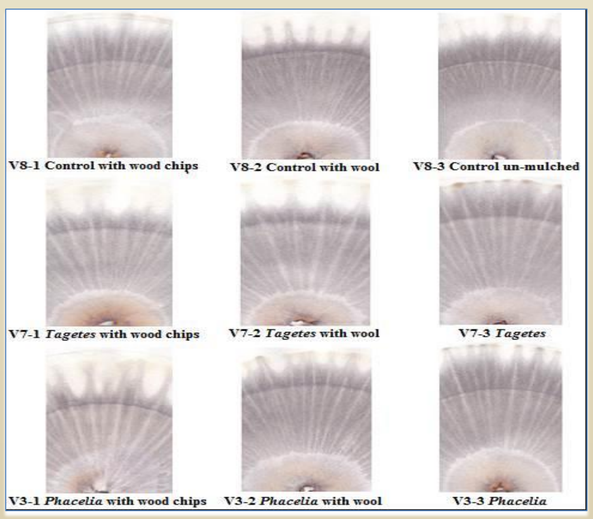
- the bacteria population significantly increased in the March 2015 – Novembre 2016, with a relative stabilisation in the last period.
- a high density of heterotrophic aerobic bacteria relative to gram of dry soil, which ranged from a minimum of 32x10^6 viable cells / g dry soil to V8.2. - Control with wool sub-variant to a maximum of 88 x 10^6 viable cells / g dry soil to the V7.2.- *Tagetes* with wood chips sub-variant .
- the application of organic technology by using organic materials (wool, wood chips) for mulching and ameliorative crops alone or combined caused significant increases in the number of heterotrophic aerobic bacteria relative to controls plots in general.
- the most important values of bacterial density registered under the effect of wool mulch were obtained at variant with *Sinapis*, followed by that of *Tagetes* as ameliorative plants, but generally using wool mulch has led to less numerous bacterial populations than in the rest of variants, especially when were used combinations of two species of ameliorative plants.

C. Influence of organic technology on fungal microflora



- fungal microflora presented values considered high: the sub- variants with wood chips V3.1. *Phacelia*, V7.1. *Tagetes* or V1.1. *Sinapis* and the sub-variants un-mulched V7.3. *Tagetes*, V2.3. *Sinapis* + *Phacelia* and V6.3. *Tagetes* + *Phacelia* .
- ubiquitorius species with high adaptive capacity and species equipped with enzymatic complex equipments, which enable efficient exploitation of a wide variety of substrates with very different origins.
- a considerable number of species capable to degrade and to metabolize organic substrates as wool, wood chips or debris of organic matter due to enzymes such as proteases (keratinases), cellulase
- many of the microorganisms, such as *Pseudomonas fluorescens*, actinomycetes, *Trichoderma viride*, *Trichoderma hazianum*, *Paecilomyces marquandii* stimulated by the presence of ameliorative plants and organic mulch act as antagonists against soil borne pathogens of genus *Fusarium*, *Phytophthora* and *Alternaria*, producing a beneficial effect on the health of edible rose culture.

D. Soils chromatograms at the variants with ameliorative plants and mulch



- an increasing silica organization due to biological activity though embattled shape of the outer edge of the central area in mulched variants, especially those with wood chips.
- clay shows most well-organized at the V3.1. *Phacelia* with wood chips sub-variant, the remaining variants presenting organization trends in different degrees of evolution, the organization level being correlate, in general, with the high level of chemical complexity.
- the content of minerals increased significantly in V7.1. *Tagetes* with wood chips sub-variant, compared with the other experimental variants.

CONCLUSIONS

- Positive results through organic technology applied to edible rose cultures were obtained by stimulating the development of fungal and bacterial microflora and increasing the global physiological activities of edaphical microorganisms compared to controls and with the initial phases. It is remarkable the beneficial effect of *Tagetes* alone or in combination with *Phacelia* on the development of bacterial and fungal microflora.
- Using wood chips mulch determined a large numbers of bacteria developing on V7. *Tagetes* variant and fungi on V7. *Tagetes*, V3. *Phacelia* variants, were was recorded the most intense soil respiration also. Using wool as mulch induced a weaker stimulation of soil microbial populations compared with wood chips, the best results being those related to soil respiration increase on V3. *Phacelia* or V7. *Tagetes* variants, or by the stimulation of bacterial increase in V1. *Sinapis* variant.
- Analysis of chromatograms revealed favorable effect on soil quality evolution in mulched variants with ameliorative plants of *Tagetes* or *Phacelia*.