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Effective Microorganisms as a Sustainable Alternative in Improving Vegetable Productivity and Maintaining Soil Quality

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Abstract:

From the beginning, an important role of the soil microflora Observed ions in the recycling of organic matter and maintenance of its fertility. However, after the Green Revolution, new farming techniques Introduced, associated with new inputs reflected in unsustainable practices, with Increased energy consumption, soil degradation and reduced food quality. In this context, the present work sought to evaluate the use of effective microorganisms in lettuce and cherry tomatoes to the sustainable cultivation strategy without the use of fertilizers or pesticides. Initially, effective microorganisms Were Obtained from home-made fermented. Subsequently, the same was applied in cultures of smooth cherry tomato and lettuce in different types of soils and Concentrations. Bacterial species present with Identifications by mass spectrometry, dry weight and general aspect of the Evaluated cultivars for the different treatments, as well as soil quality, organic matter and chemical constituents concentration terms. Quantitative microbiological evaluation was determined by dilution of samples in saline soil in MH medium and plating. It is possible to observe que in addition Involving Both treatments of the fermented in the different Concentrations gave higher plant production and concentration of organic matter, as well as higher counts of CFU / mL Compared to the control treatments. This fact evidences the efficacy of the fermented product produced and Whose pH That Suggests it contains important organic acids present in the microorganisms. The microorganisms were found mostly identified the Bacillus sp, reported by authors of the works being Several important inducers of plant growth.

Key Words: Effective microorganisms; Sustainable cultivation; lettuce; Tomato.

Introduction:

In ancient times the company grew their own food, based on sustainable farming practices and healthier ourselves, keeping dynamic balance between man and nature. However, over the years, working tools have improved and new farming technologies have been developed and adopted, as the use of various agricultural machinery and implements, which began to be used in the "modern" agriculture, especially in post-war (World war II). (LOPES, 2011), As Lopes (2011) during the Green Revolution, there were changes in agriculture, it was a period of history in which new technological inventions and dissemination of genetically modified seeds were created, allowing for a vast increase in agricultural production from 1950. These inventions and changes brought several consequences to the rural environment, resulting exodus to urban areas, with the impoverishment of thousands of farmers. Furthermore, there was intensification of dependence on agricultural inputs, reducing the productive capacity of soils, generating mass of cultural diversity, water contamination and depletion of natural resources. These changes brought with the predominant use and unbridled form of non-renewable energy, mainly based on petroleum products. According to Gliessman (2005), technological advance in agriculture which are established over time, mainly due to technological advancement, is expressed in numerous adverse effects in the medium and long term. It is noteworthy in this context the reduction of soil fertility, loss of organic matter, nutrient leaching, degradation, and increased soil erosion, contamination and exhaustion of the water sources, increase in diseases, contamination of agricultural

environments, natural ecosystems, damage to health farmers and agricultural workers, destruction of beneficial insects and microorganisms, drastic reduction of biodiversity and regional imbalances in the global nitrogen cycle with consequent worsening of the problems in the ozone layer.

> *Technological activities (industrial, plastic, textile, microelectronics, wood preservatives, mining waste, tailings, smelting, agrochemicals - fertilizers, farm manure, pesticides, aerosols, pyro-metallurgical exhaustion and automobile, biosolids - sewage sludge, household waste fly-ash product coal combustion) are the major sources of contamination and pollution of heavy metals in the environment, and geogênicas sources. (MA, 2010*

Much research intensified in order to solve the problems generated by agricultural modernization. As scores Moreira (2003), there are growing concerns about food quality and environmental and economic issues related to agricultural production processes, making it necessary to investigate alternative forms of natural resource management. This need arises in order to seek strategies to respond positively to the challenges of sustainable agricultural production, preservation of socio-cultural biodiversity, providing viable alternatives to small and medium farmers, minimizing environmental crises generated from the rural development model and technological linking them to the paradigms of the Green Revolution. As reconstruction possibility arise so-called Efficient Microorganisms (EM), whose concept was developed by Prof. Teruo Higa, University of the Ryukyus in Okinawa, Japan (HIGA, 1991).
Ahmed et al. (2014) understands that:

> *EM consist of a combination of cultures of beneficial microorganisms found naturally in soil and may be applied as inoculants to increase the microbial biodiversity.*

The same studies indicate that research has shown that inoculation of cultures the soil ecosystem of plants and enhances the quality and soil health, growth, yield and quality of crops. EM are also known as Bokashi, Japanese term denoting "fermented organic matter." It is an anaerobic fermentation process that produces a material which can be used as fertilizer "slow release" in the soil. During this process the complex structures are assimilated by the microorganisms. However, due to lack of oxygen, the organic material is not completely mineralized to CO2, water and heat (anaerobic process) compared with traditional compost. Composting has considerably lower energy losses that applying to soils Bokashi compounds that increases the amount of microorganisms and improves the physical characteristics of the soil. Also, do not produce putrid odor, has no insect or rodent problems and does not cause loss of nutrients. (Ahmed et al, 2014), Important information raised by Higa (1994) is the fact that these microorganisms are applied in agriculture with the main purpose to stand out in relation to so-called harmful microorganisms, bringing a number of advantages, among which act as components of organic fertilizer as they are microorganisms capable of inoculating and fix nitrogen, also acting as a suppressor of insects and plant diseases, as well as significant improvement in the quality and yield of crops. An important consideration is that, when effective microorganisms are applied, there is the elevation of their synergistic effects, as in the case of the use of chemical fertilizers and pesticides, but without the attacks caused by them. According Boechat et al (2013) EM promote beneficial effects rapidly, as well as richer end products. The EM is a suspension in which coexist over ten gender and species of microorganisms effective eighty, as reported Khatounian (2001). Some studies point to the fact that EM are constituted by four major groups of microorganisms, yeasts, actinomycetes, bacteria producing lactic acid and photosynthetic bacteria, microorganisms that can assist in promoting plant growth and improve soil quality. However, while performing very important functions for crop development, Higa and Wididana (1991) point out that EM do not replace other management practices. Thus, the EM open new perspective for the optimization and combination with farming practices such as crop rotation, use of organic manure, sustainable management, waste recycling and biological pest control. Faced with the environmental consequences caused, over time, with the use of pesticides associated with the various modern technologies of cultivation, it is essential to study and search for new alternatives that can ensure sustainable use of soils. In this context, the use of EM comes as an interesting strategy to achieve the call sustainable productivity. Based on these considerations, the present work sought to examine the effects of application of EM present in fermented produced from home form, on Lactuca sativa cultivation (plain lettuce) and Solanum

lycopersicum (tomato) in different soil types and different concentrations.

Methodology:

Fermented Preparation:

The fermented containing EM was prepared according to the technical manual Bokashi (SIQUEIRA, 2013). Cooked were a total of 700g of rice Type 2 (Camil®) in water without added seasonings. Later, that volume was divided into two plastic containers, covered by thin cloth in order to prevent invasion of insects, yet allowing the passage of air. The two containers were placed in closed virgin forest in the region of Bela Vista neighborhood, municipality Divinópolis MG, left at this location covered by dry leaves. After 7 days, the containers were opened and collected only the parts of the rice grains that had color (red, pink, yellow, blue, green), that was already in the process of decomposition. These parts were divided into five two-liter PET bottles, which were completed, each, 200 mL of boiled water and cane juice. At intervals of 48 hours the bottles were opened and released all the gas was being produced inside. At the end of 15 days the fermentation was already ready to use, with the same kept in a cool environment (Figure 01). All experimental steps were performed in the laboratory preceded by primary care aseptically, using biological safety cabinet and sterilization of materials in an autoclave at 1 atm pressure for a period of 20 minutes at most stages of the work.

Figure 01: Fermented preparation steps the cooked rice base. Source: Nathalia Hiratsuka

Treatments applied in the cultivation of seedlings:

For tests with the cultivars were used 54 cherry tomato seedlings and 54 seedlings of lettuce, being acquired in local public fair, grown on the farm in place of same physiognomy of Cerrado. Experiments were conducted with three replications in two soil treatment: soil prepared (SP) and spraying (S) for a total of four fermented dilutions in water chlorine-free 1: 100, 2: 100, 4: 100, 1:10; for two types of soil: plant suitable for planting, the topsoil (TS) and virgin soil collected in a batch (VS) as shown in Figure 02 below. In soil preparation experiment (SP) was applied in all replications, TS as well as VS, once in a total of 300 mL of the fermented in their respective dilution. Then, the seedlings planted were watered with chlorine free water at 48h intervals, approximately 1:00 PM. The spraying experiment (S) seedlings were planted and sprayed weekly on their respective dilutions, watered as in 48h intervals, also with chlorine-free water.

	DILUTION	LETTUCE VS			LETTUCE TS			TOMATO VS			TOMATO TS		
SP	1: 100	1	2	3	1	2	3	1	2	3	1	2	3
	2: 100	1	2	3	1	2	3	1	2	3	1	2	3
	4: 100	1	2	3	1	2	3	1	2	3	1	2	3
	1: 10	1	2	3	1	2	3	1	2	3	1	2	3
S	1: 100	1	2	3	1	2	3	1	2	3	1	2	3
	2: 100	1	2	3	1	2	3	1	2	3	1	2	3
	4: 100	1	2	3	1	2	3	1	2	3	1	2	3
	1: 10	1	2	3	1	2	3	1	2	3	1	2	3
		C			1	2	3	1	2	3			
					1	2	3	1	2	3			

Figure 02: Map of samples. Legend: ST: Treatment done preparing the soil before planting; S: Treatment by spraying; C: control treatments without addition of fermentated; VS: planted in virgin soil; TS: Planted in Topsoil proper for planting; 1,2,3: samples; DILUTION: fermented measures diluted in water (per mL).

The seedlings were planted in plastic containers, which were made little holes on the bottom and added 300g of gravel in each, plus 200g of sand mixed with 600g of soil.

Figure 03: Sample plots represented by tomato and lettuce seedlings. Source: Nathalia Hiratsuka.

Isolation and identification of microorganisms in fermented:

Fermented samples were aseptically diluted with saline 0.85% (w / v), and 10µL volume of the dilutions inoculated onto petri dishes containing agar medium Muellher Hinton® (MH), using the spread plate technique. After 24 hours incubation at 37ºC, plates were removed and the colonies which showed obvious morphological differences were replicated into new plates containing Mueller Hinton Agar to obtain pure cultures. Three replicates of each dilution of the fermented were performed (Figure 04). Subsequently, after further incubation step at 37ºC plates containing pure cultures were sent to the Department of Veterinary Universidade Federal de Minas Gerais (UFMG) in Belo Horizonte in order to identify the bacterial species by mass spectrometry.

Figure 04: Steps of isolation of microorganisms in fermented. Source: Nathalia Hiratsuka.

Quantitative evaluation of the bacterial community present in soil samples:

Tests were conducted with soil samples based on dilution in saline NaCl 0.85% (w / v) sterile and platings on MH agar medium, in order to quantify and assess any quantitative differences in the microbiota from the different treatments. Initially, a total 10g of each soil sample was placed in sterile Erlenmeyer flasks containing 90mL of sterile saline 0.85% (w / v). The flasks were allowed to stir in Shaker (Solab®) at 30 and 200 rpm for 15 minutes. Then serial dilutions were performed in saline 0.85% (w / v) sterile accompanied by platings 10µL aliquots of the samples in petri plates containing MH agar (Tortora et al., 2012). (Figure 05) Then the inoculated plates were incubated at 37°C and monitored for the bacterial growth in order to counts and obtaining CFU/mL-1 in dilution which counts exceeded 25 Colony Forming Units (CFU) and were below 300 CFU/mL-1 . In total, 96 plates were prepared with three replicates for each treatment, as follows: Control 1: 100 mL, 4: 1 and 100mL: 10mL.

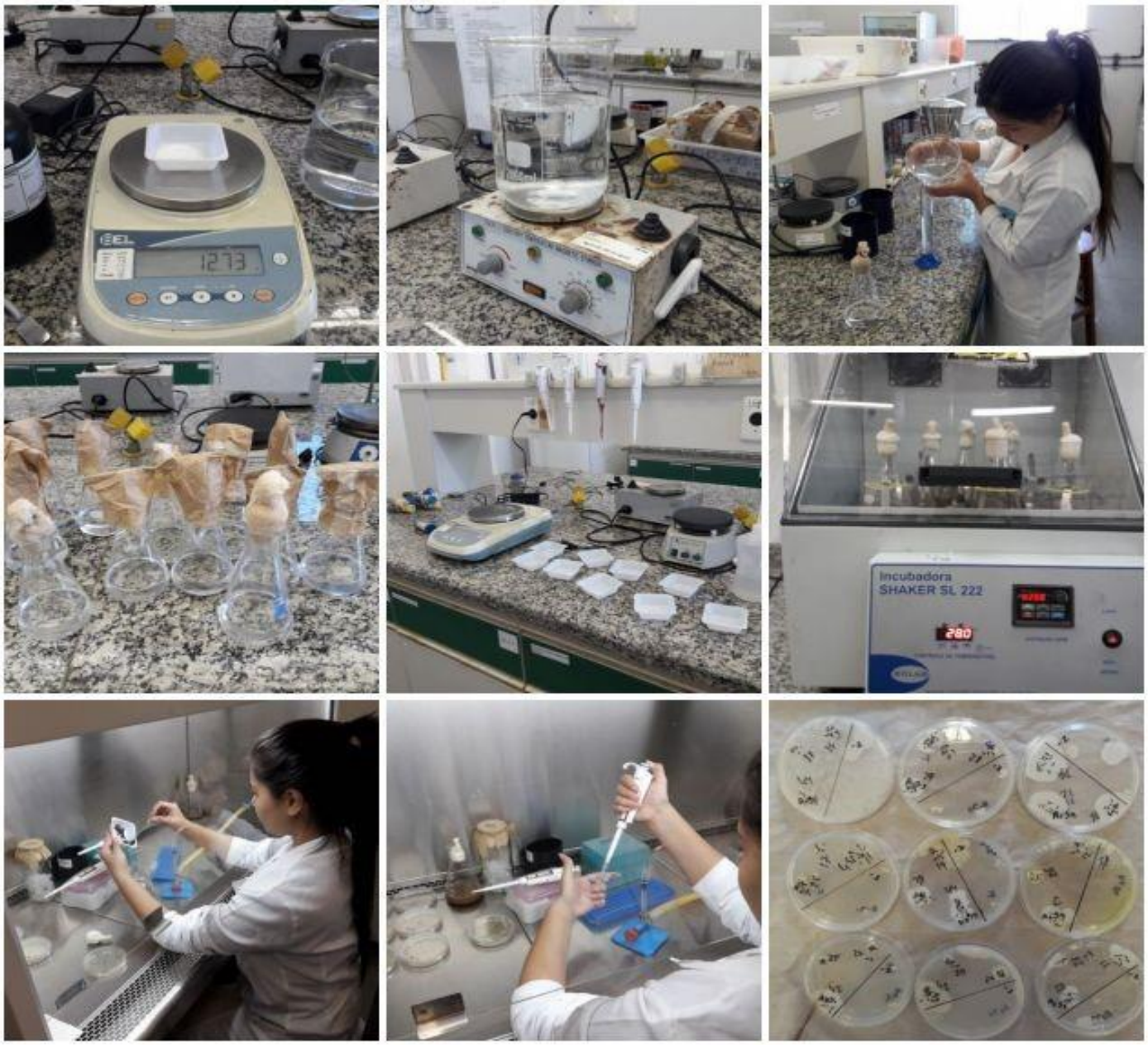

Figure 05: Illustration of steps for the quantitative analysis of microorganisms present in each of the soil samples. Source: Nathalia Hiratsuka

Dry weight assessment of cultivated vegetables:

Seedlings grown in TS were harvested 50 days after planting, had cuted their roots and then, the fresh material was performed on analytical balance mark BEL Engeneering® and placed in a greenhouse at 60°C DeLeo® marks, where they remained until complete stabilization of its weight. Virgin soil seedlings also underwent identical procedures in order to obtain the dry weight thereof (Figure 06).

Figure 06: Illustration of the steps to obtain the dry weight of the aerial part of greenery. Source: Nathalia Hiratsuka.

Analysis of the organic matter and physicochemical of cultivated soils:

Samples of each cultivated soil they have been sent to the Soil Quality Analysis Laboratory of the Federal Institute of Minas Gerais - Campus Bambuí MG (IFMG). Figure 07 below illustrates the identification of samples sent to the Institute.

SAMPLE	
1	Control/lettuce/TS
2	Lettuce/TS/S/D3
3	Lettuce/TS/ST/D4
4	Control/lettuce/VS
5	Lettuce/VS/S/D4
6	Lettuce/VS/ST/D1
7	Control/tomato/TS
8	Tomato/TS/S/D3
9	Tomato/TS/ST/D3
10	Control/Tomato/VS
11	Tomato/VS/S/D1
12	Tomato/VS/ST/D3

Figure 07: Samples were identified by numbers corresponding vegetables (lettuce and tomato), type of soil (topsoil - TS or virgin soil - VS), treatment (Spraying – S or soil tillage - ST) and Dilution (D1=1:100, D2=2:100, D3=4:100 and D4=1:10). Source: Nathalia Hiratsuka.

Results:

Aspect of the Cultivars After Cultivation Period:

Based on the various treatments employed are easily noticeable differences on the development of lettuce and tomato cultivars, as illustrated in Figures 8 and 9 below, compared to the control. It can be seen in Figure 08 (pictures left) differences in the development of cultivars subjected to treatment in topsoil and virgin soil and the right four images of samples by up and profile views, kept in topsoil (above: cultivars lettuce and below for tomato cultivars, both compared with the control treatment, this development significantly less).

Figure 08: Left: development of all cultivars after 30 days of cultivation. Right: images made for comparisons. Above and below lettuce cultivars of tomato cultivars, both in soil ready for plant (TS). For plant profile images, the right side control treatment of the sample with the dilution of 1: 10mL of the fermentation, and the images made over the plant control treatment under the sample application fermented. Source: Nathalia Hiratsuka.

Figure 09: Cultivation of lettuce seedlings in TS after 50 days of planting. In the left, control treatment and in the right, treatment dilution of fermented 1: 10 mL. Source: Nathalia Hiratsuka.

Bacteriological evaluation of fermented:

After implementation of the general Gram staining and morphological characterization of bacteria isolated colonies fermented, pure colonies were subjected to identification using mass spectrometry to the analysis of ribosomal proteins. It was possible to note the prevalence of Gram positive, rod-shaped, belonging to the genus Bacillus sp. and B. cereus species present in three of the samples (Table 01).

Número da amostra	Identificação da amostra	Meio de cultura	Resultado
1	N1	MH	*Bacillus cereus*
2	N2	MH	*Bacillus* sp.
3	N3	MH	*Bacillus cereus*
4	N4	MH	*Bacillus cereus*

Table 01: Bacterial Identification by mass spectrometry of the isolated species of fermented.

pH Evaluation of the Produced Fermented:

The fermented samples were collected pH, using pH meter Methrom® mark, yielding mean values close to 2.9, thus indicating the presence of acids in the samples, probably due to the production of organic acids by bacteria identified (Figure 10).

Figure 10: Illustration of the evaluation step the pH of the unfermented samples.
Source: Nathalia Hiratsuka.

Obtaining Yeast Colonies from Fermented Samples:

After inoculation of 100 ul aliquots of the fermentation in petri dishes containing agar Sabouraud®, followed by incubating in an incubator at 28 ° C for 48 hours, it was possible to obtain different growth of fungal colonies, identified by gross morphological differences, although similar for each sample evaluated (Figure 11).

Figure 11: Illustration of fermented fungal colonies obtained after inoculation of the samples on agar plates Sabouraud®. Source: Nathalia Hiratsuka.

Quantification of bacteria present in soil samples:

From the quantification of bacteria isolated from soil samples seeded with tomato and lettuce, realizes a higher concentration of microorganisms compared to control, for the samples treated with the fermented (Figures 1 and 2). The highest values were obtained for treatment with topsoil (TS), 1:10 dilution of the fermented mL (D4) and treatment with soil preparation (SP) as well as in the treatment of fermented dilution 1: 100 mL in SP treatment and virgin soil (VS) (Figure 01).

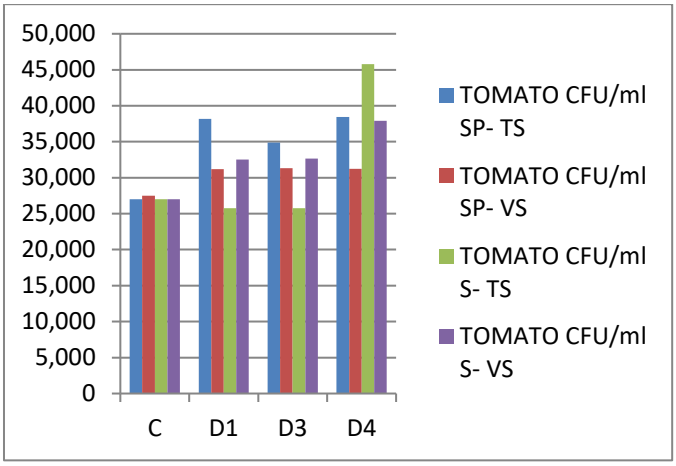

Figure 01: Number of bacterial colonies (CFU / mL) isolated from soil samples used in the cultivation of tomato cherry for different treatments for different treatments with fermented (dilutions in water: D1 = 1: 100mL, D3 = 4: 100 mL and D4 = 1: 10 mL); C: without the addition of fermented; SP: Soil preparation; S: Spraying; TS: topsoil; VS: virgin soil.

For lettuce samples realize a higher bacterial concentration in soils treated with the fermented compared to the controls, especially for the treatment in 1: 100 dilution (D1) in virgin soil (VS) with soil preparation (SP), and at 1:10 dilution (D4) in topsoil (TS), and soil preparation (SP) (Figure 02).

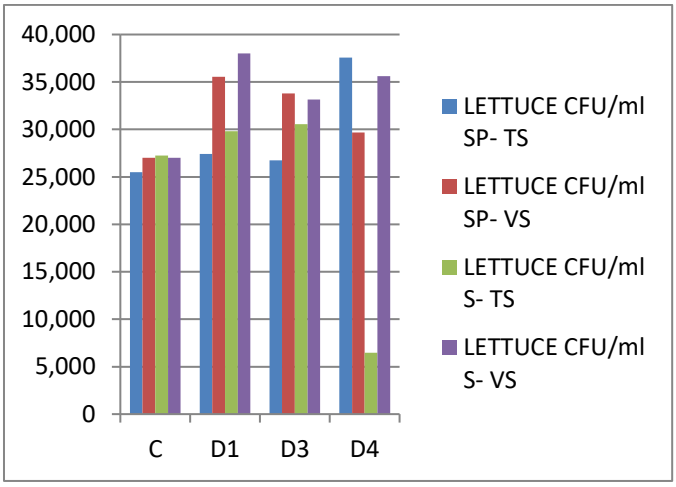

Figure 02: Concentration of bacterial colonies (CFU / mL) in the samples with lettuce cultivation for different treatments for different treatments with fermented (dilutions in water: D1 = 1: 100mL, D3 = 4: 100mL and D4 = 1: 10 mL); C: without the addition of fermented; SP: Soil preparation; S: Spraying; TS: topsoil; VS: virgin soil.

Dry Weight of the Evaluation of Cultivars:

Seedlings lettuce treated with the fermented dilution 1: 10mL grown in topsoil (TS) and preceded by prepared soil (PS) showed the best results in terms of shoot development based on the dry weight obtained (Figure 03).

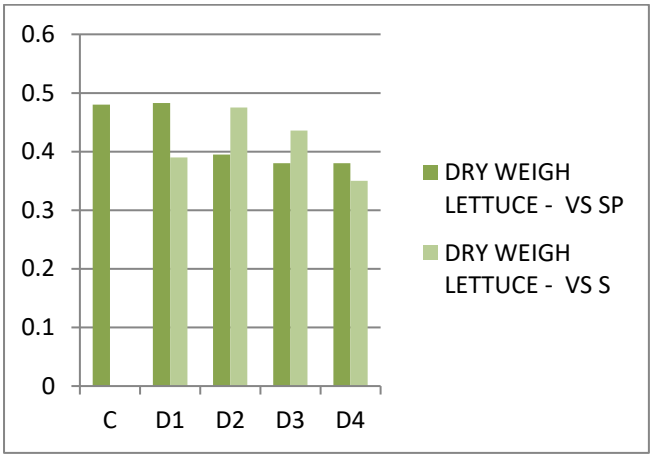

Figure 03: Dry weight (g) of the aerial parts of lettuce seedlings grown in topsoil (TS) and subjected to different treatments with fermented (dilutions in water D1 = 1: 100mL, D2 = 2: 100mL, D3 = 4:100 and D4 = 1:10mL); C: without the addition of fermented; SP: Soil preparation; S: Spraying; TS: topsoil.

For lettuce seedlings grown in virgin soil no significant differences were observed for the best treatment (D1) compared to the control in terms of dry weight of the aerial parts of the crops (Figure 04).

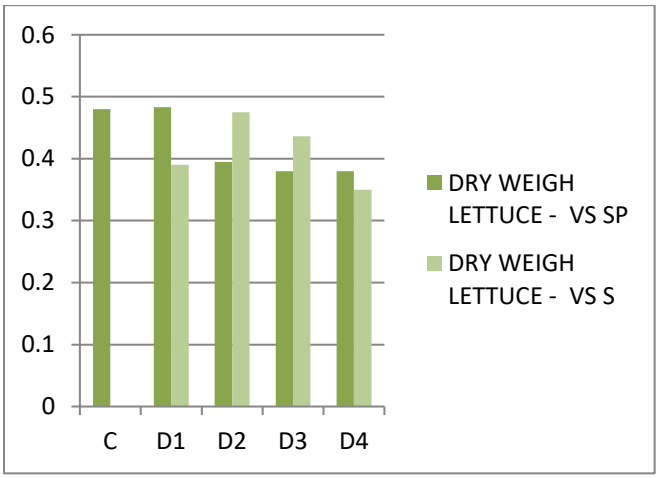

Figure 04: Dry weight (g) of the aerial parts of lettuce seedlings cultivating virgin soil (VS) for the different treatments with fermented (dilutions in water: D1 = 1: 100mL, D2 = 2: 100mL, D3 = 4:100 and D4 = 1: 10mL); C: without the addition of fermented; SP: Soil preparation; S: Spraying; VS: virgin soil.

For tomatoes were prominent in terms of dry weight of the aerial parts of the plants, cultivars subjected to treatment in virgin soil (VS) with soil preparation (SP) and dilution of the fermented 1: 10mL (D4) (Figure 05).

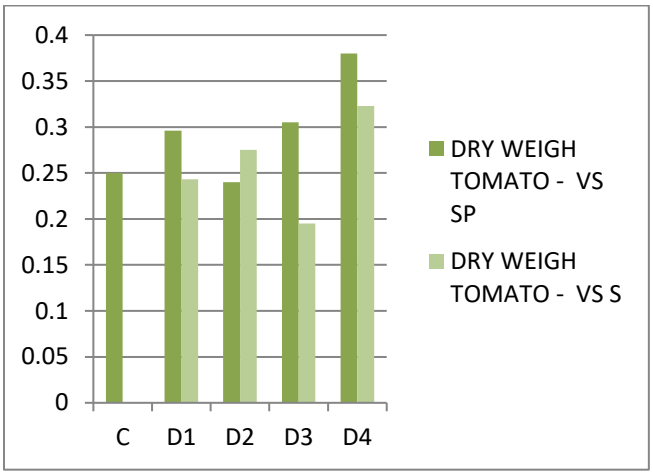

Figure 05: Dry weight (g) of the aerial parts of cherry tomato seedlings grown in virgin soil (VS) with different treatments with fermented (dilutions in water: D1 = 1: 100mL, D2 = 2: 100mL, D3 = 4 :100 mL and D4 = 1:10mL); C: without the addition of fermented; SP: Soil preparation; S: Spraying; TS: topsoil; VS: virgin soil.

In the case of cultivation in topsoil (TS) developing the best performance tomato cultivar was obtained by dilution of the fermented in the ratio 2: 100 mL (D2) with soil preparation, compared to the control treatment. In addition to the reported difference was also observed in the emergence of fruit seedlings subjected to that treatment, different from that observed for the control samples.

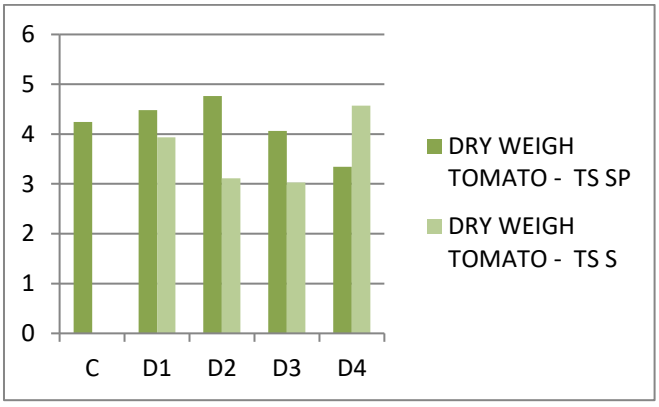

Figure 06: Dry weight (g) of the aerial parts of cherry tomato seedlings grown in topsoil (TS) for the different treatments with fermented (dilutions in water: D1 = 1: 100mL, D2 = 2: 100mL, D3 = 4 :100 mL and D4 = 1:10mL); C: without the addition of fermented; SP: Soil preparation; S: Spraying; TS: topsoil; VS: virgin soil.

Fruit Appearance Assessment in Tomato Cultivars Cherry:

Throughout the cultivation of cherry tomato seedlings in vegetable soil and subjected to treatment with the fermented 1:10 dilution in mL, the fruit development was observed as shown in

Figure 12, particularly for that treatment both in terms of fruit weight as obtained in the same amount (Figures 7 and 8).

Figure 12: Fruits from tomato seedlings planted on TV.

Source: Nathalia Hiratsuka

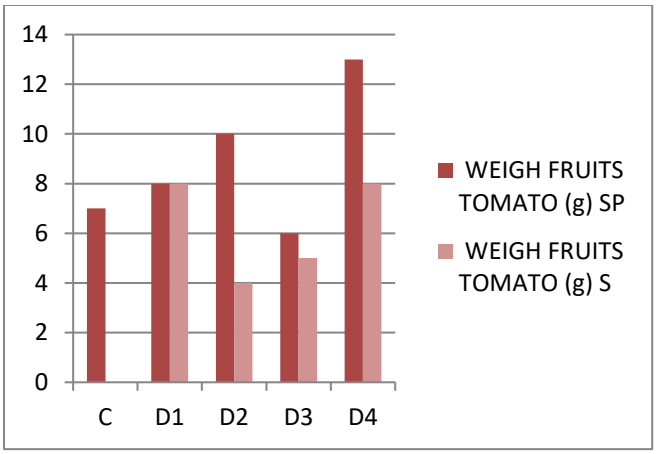

Figure 07: Weight (g) of the fruits produced in cherry tomato seedlings grown in topsoil (TS) for the different treatments with fermented (dilutions in water: D1 = 1: 100mL, D2 = 2: 100mL, D3 = 4: 100 mL and D4 = 1: 10 mL); C: without the addition of fermented; SP: Soil preparation; S: Spray; TS: topsoil; VS: virgin soil.

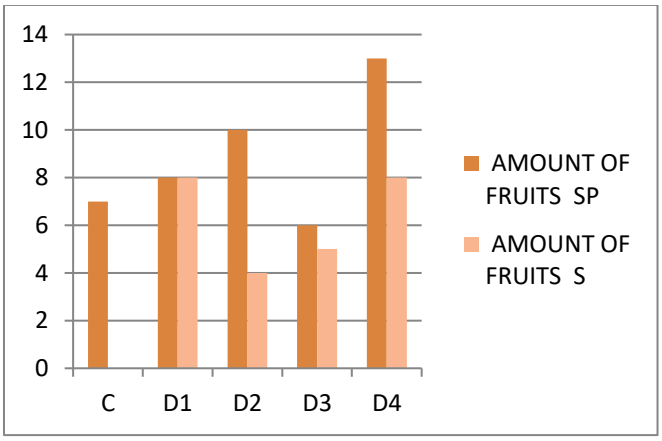

Figure 08: Fruit count produced by cherry tomato seedlings grown in TS, ground preparation and spraying for different treatments with fermented (dilutions in water: D1 = 1: 100mL, D2 = 2: 100mL, D3 = 4: 100 mL and D4 = 1: 10 mL); C: without the addition of fermented; SP: Soil preparation; S: Spray; TS: topsoil; VS: virgin soil.

Analysis of the Organic Matter and Minerals Present in the Soil Treated with the Fermented:

From the results of the analysis of organic matter and minerals present in the soil cultivated with lettuce and cherry tomatoes, TS or VS, and subjected to different treatments with fermented, it was noticeable best overall results with TS, especially the tomato in Spraying treatment and dilution 4: 100mL (Table 2).

Descrição da amostra	pH	P (melh	K	Ca	Mg	Al	H+Al	SB	t	T	V	m	M.O.	C.O.	Ca/T	Mg/T	K/T	H+Al/T	Ca+Mg/T	Ca/Mg	Ca/K	Mg/k	Ca+Mg/K
1-Alface/Controle/TV	5,7	295,2	700	5,41	1,81	0	2,36	9	9	11,4	79,2	0	2,71	1,57	48	16	16	21	64	3	3	1	4
2-Alface/Dil.3/Pulv/TV	5,7	585,2	875	11,68	2,78	0	2,65	16,7	17	19,4	86,3	0	3,32	1,93	60	14	12	14	75	4	5	1	6,5
3-Alface/Dil.4/PT/TV	5,5	756,7	900	13,99	2,72	0	2,85	19	19	21,9	87	0	2,81	1,63	64	12	10	13	76	5	6	1	7,3
4-Alface/Controle/TB	4,8	2,3	21	0,57	0,11	0,31	4,25	0,7	1	5	14,7	29,8	1,28	0,74	11	2	1	85	14	5	11	2	13,6
5-Alface/Dil.4/Pulv/TB	4,7	0,3	25	0,57	0,12	0,35	5,76	0,8	1,1	6,5	11,5	31,8	1,57	0,91	9	2	1	88	11	5	10	2	11,5
6-Alface/Dil.1/PT/TB	4,8	0,4	29	0,51	0,12	0,28	4,72	0,7	1	5,4	12,9	28,6	1,41	0,82	9	2	1	87	12	4	7	2	9
7-Tomate/Controle/TV	5,7	607,7	1150	11,72	2,55	0	2,65	17,2	17	19,9	86,7	0	2,89	1,68	59	13	15	13	72	5	4	1	4,9
8-Tomate/Dil.3/Pulv/TV	5,7	602,4	1100	13,99	2,94	0	2,62	19,7	20	22,4	88,3	0	3,68	2,13	63	13	13	12	76	5	5	1	6
9-Tomate/Dil.3/PT/TV	5,7	558,2	1000	13,5	2,72	0	2,7	18,8	19	21,5	87,4	0	2,96	1,72	63	13	12	13	76	5	5	1	6,3
10-Tomate/Controle/TB	4,8	4,8	28	0,63	0,16	0,28	4,82	0,9	1,1	5,7	15,1	24,6	1,4	0,81	11	3	1	85	14	4	9	2	11,3
11-Tomate/Dil.1/Pulv/TB	4,7	4,7	13	0,53	0,11	0,35	4,97	0,7	1	5,6	11,9	34,3	1,44	0,84	9	2	0	88	11	5	18	4	21,3
12-Tomate/Dil.3/PT/TB	4,8	4,8	20	0,56	0,15	0,3	5,24	0,8	1,1	6	12,7	28,3	1,55	0,9	9	2	1	87	12	4	11	3	14,2

Table 2: Amounts of organic matter and minerals obtained in TS and VS samples subjected to different treatments with fermented in tomato and lettuce cultivars.

Discussion:

The results obtained in this work corroborate those found from studies of other authors regarding the identification of the bacterial species present in the fermented. As puts NIU et al (2011), *B. cereus* is a promoting rhizobacteria plant growth inducing resistance against a broad spectrum of pathogens, still acting as a promising biocontrol agent (GUO et al 2007). Therefore, their presence in fermented justifies the good overall results in productivity when treatments with fermented were compared to the control. Already on other species of the genus *Bacillus*, Kloepper et al (2004) report that:

> *Causing ISR (systemic induced resistance) and also the promotion of plant growth. Studies on mechanisms indicate that the elicitation of the ISR by Bacillus spp. It is associated with ultrastructural changes in plants during attack pathogens and cytochemical changes. Investigations of the signal transduction pathways induced plants suggested that Bacillus spp., Activate some of the same paths that Pseudomonas spp.*

Gomes (2013), in turn, reports:

> *The Bacillus genus belonging to Bacillaceae family, is extremely heterogeneous, both genetically, as phenotypically. It consists of environmental microorganisms whose primary habitat is the soil where they have an important role in carbon and nitrogen cycle. Resistance of spores and vegetative forms diversity of physiological make are considered ubiquitous and can be isolated from soil, sea water and fresh foodstuff d'water.*

pH values near 2.9, the obtained measurement samples from the fermentation, indicate the probable presence of organic acids produced by microorganisms present therein, which may also be acting as plant growth factors, associated even confirming the presence of fungal species also associated with best induction of plant growth response.Bacterial quantitation confirmed with greater concentration in the fermented treatments compared to controls. This can also be associated to the higher dry weight observed in plants subjected to treatment with the application of fermented vegetable mold and the lower dilution thereof. Likewise, one can also associate the largest and fastest fruit production in tomato seedlings subjected to treatment with the fermentation. According Suthamathy and Seran(2013, cited by Godinez, 2017) Applying the compounds of Bokashi increases the amount of soil microorganisms, improves the physical characteristics of the soil and increases the supply of nutrients for the plants. According to the authors, when compared with traditional composting, compounds from fermantados with EM promote significantly better response. The analysis of soil samples, as regards the quantification of mineral and organic matter present, proving the fact that the treatments with fermented promoted enrichment of those samples, reflected in better productivity gains in fruit production and development of the aerial parts. The presence of such enriching nutrients and soil was also observed in studies Tallat (2015) which indicate that the presence of AT guarantee optimal concentration of N, P, K, Ca, Mg, Fe, Zn and Cu, as well as increased accumulation of soluble sugars, free amino acids, proline and glycinebetaine, lower lipid peroxidation and higher levels of in than in untreated soil. There are few reports in the literature dealing with EM, especially microbiological composition and effects on cherry tomato and lettuce crops, this work being one of the pioneers in that subject.

Conclusion:

In this study we determined the effectiveness of fermented produced by hand in terms of increasing plant productivity in lettuce and tomato seedlings. The addition of the fermented, in different concentrations, improved aspects related to the growth of the aerial parts of the plants, improvements in fruit production in soil quality, as regards the organic matter and minerals, as well as increase the concentration of microorganisms in the soil compared to control treatments. The microorganisms found were mostly belonging to the genus *Bacillus*, reported by several authors as plant growth-inducing. The results obtained for fermented pH also indicate the presence of organic acids in solution, elements of great importance to plant development.

References:

1) Ahmed, FF ABADA, MEM, ALI, AH, Allam HM Trials for partially replacing inorganic N in the upper vineyard by using N slow release fertilizers, humic acid and MS. Stem Cell, v.5, P. 16-29, mar. 2014.
2) BOECHAT, CL, SANTOS, JAG, ACCIOLY, AMA Net nitrogen mineralization and soil chemical changes with application of organic wastes with Fermented Bokashi compost. Acta Scientiarum Agron, v. 35, p. 257-264, jun. 2013.
3) GLIESSMAN, SR Agroecology: ecological processes in sustainable agriculture. 3rd ed. Porto Alegre: UFRGS, 2005.
4) GLIESSMAN, SR Agroecology: ecological processes in sustainable agriculture. 2 ed. Porto Alegre: UFRGS, 2000.

5) Godinez, EAP, Zarate, JL, Hernandez, JC-BARAIAS ACEVES, M. Growth and reproductive potential of Eisenia foetida (Sav) Dungs on various zoo animals after two methods of pre-composting Followed by vermicomposting. Waste Management, V.64, p.67-78, jun. 2017.IT HURTS: https://doi.org/10.1016/j.wasman.2017.03.036
6) Gomes, M. JP. Genus Bacillus Spp. Topics in Bacteriology Veterinary FAVET-UFRGS, 2013.
7) HIGA, T. Effective microorganisms: The Biotechnology for mankind. In: PARR, JF, Hornick, SB, WHITMAN, CE Proceedings of the First International Conference on Nature Farming Kyusei. Washington: Department of Agriculture, 1991. p. 8-14.
8) HIGA, T. Effective Microorganisms: A new dimension for Nature Farm-ing. In: PARR, JF, Hornick, SB, SIMPSON, ME Proceedings of the Second International Conference on Nature Farming Kyusei. Washington: Department of Agriculture, 1994. p. 20-22.
9) HIGA, T. WIDDIANA, NG Changes in soil microflora induced by the Effective Microorganisms. In: PARR, JF, Hornick, SB, Whitman, C. Proceedings of the First International Conference on Kyusei Nature Farming. Washington: Department of Agriculture, 1991. p. 153-162.
10) HIGA, T., WIDDIANA, GN the concept and theories of Effective Microorganisms. In: PARR, JF, Hornick, SB, Whitman, C. Proceedings of the First International Conference on Kyusei Nature Farming. Washington: Department of Agriculture, 1991. p. 118-124
11) HIGA, T. Effective microorganisms: Their role in Kyusei Nature Farming and sustainable agriculture. In: PARR, JF, Hornick, SB, Simpson, ME Proceedings of the Third International Conference on Kyusei Nature Farming. Washington: Department of Agriculture, 1995.
12) KHATOUNIAN, CA The ecological reconstruction of agriculture. Botucatu: Agroecology, 2001.
13) LOPES, PR Magazine Dialogue Space and disconnection, Araraquara, v. 4, no. 1, mar. 2011.
14) MA, Y. Prasad, MSK, Rajkumar, M., Freitas, HJ Plant growth Promoting Rhizobacteria endophytes and accelerate phytoremediation of metalliferous soils.Biotechnology Advances, vol. 29, n. 2, p.248-258, abr. 2010. IT HURTS: https://doi.org/10.1016/j.biotechadv.2010.12.001
15) MOREIRA, RM agroecological transition: concepts, social bases and the town of Botucatu / SP - Brazil. Thesis (MA in Agricultural Engineering) - Economic Institute, State University of Campinas, Campinas, 2003.
16) NIU, DD, Liu, HC, Jiang, C, Wang YP, Wang, QY, Jin, HL, Guo, HThe plant growth-promoting rhizobacterium Bacillus cereus AR156 induces systemic resistance in Arabidopsis thaliana by simultaneously activating salicylate- and jasmonate / ethylene-dependent signaling pathways. The American Society hytopathological. v. 24, no. 5, p. 533-542, may. 2011. IT HURTS: https://doi.org/10.1094/MPMI-09-10-0213
17) Siqueira, Ana Paula Pegorer of. SIQUEIRA, Manoel FB. Bokashi: Fermented organic fertilizer. Niteroi: Rio Rural Program. Technical Manual, 40, 2013.
18) Talaat, Neveen B. GHONIEM, AE, Abdelhamid, MT shawky, BT Improve Effective microorganism's growth performance alter nutrient acquisition and compatible solutes induce accumulation in common bean (Phaseolus vulgaris L.) plants Subjected to salinity stress. Plant Growth Regulation. v.75, p.281-295. Jan. 2015.
19) TORTORA, GJ, FUNKE, BR, CASE, CL, Microbiology. 10 Ed Porto Alegre. Artmed 2012.